CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

NOVEMBER 15, 1944

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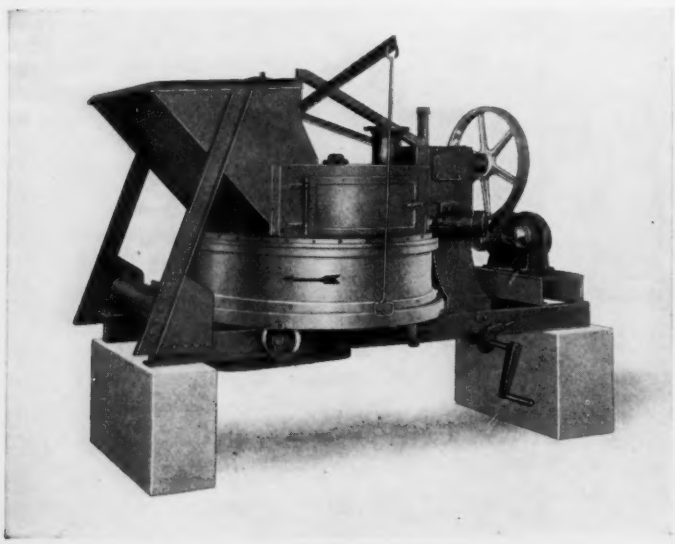

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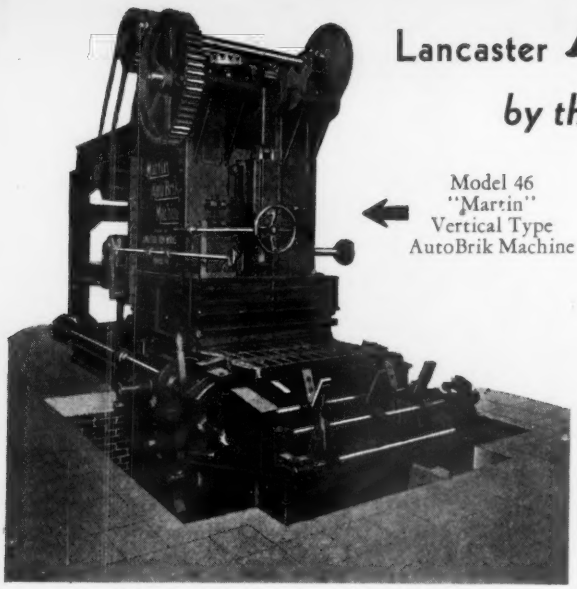

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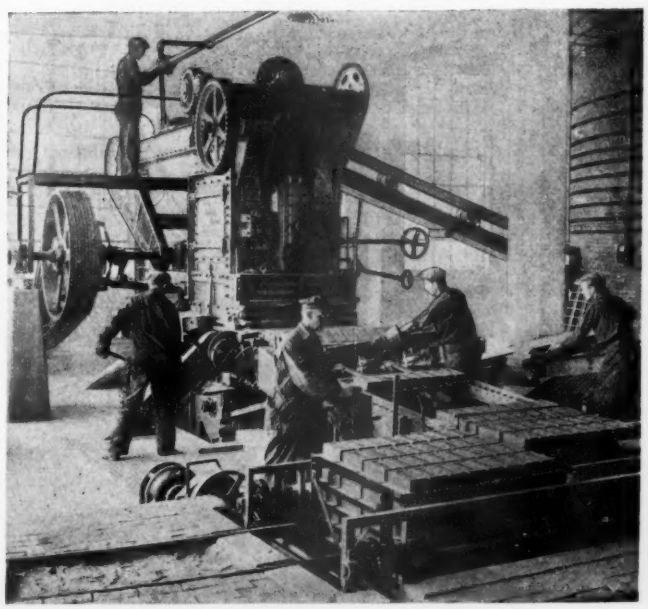

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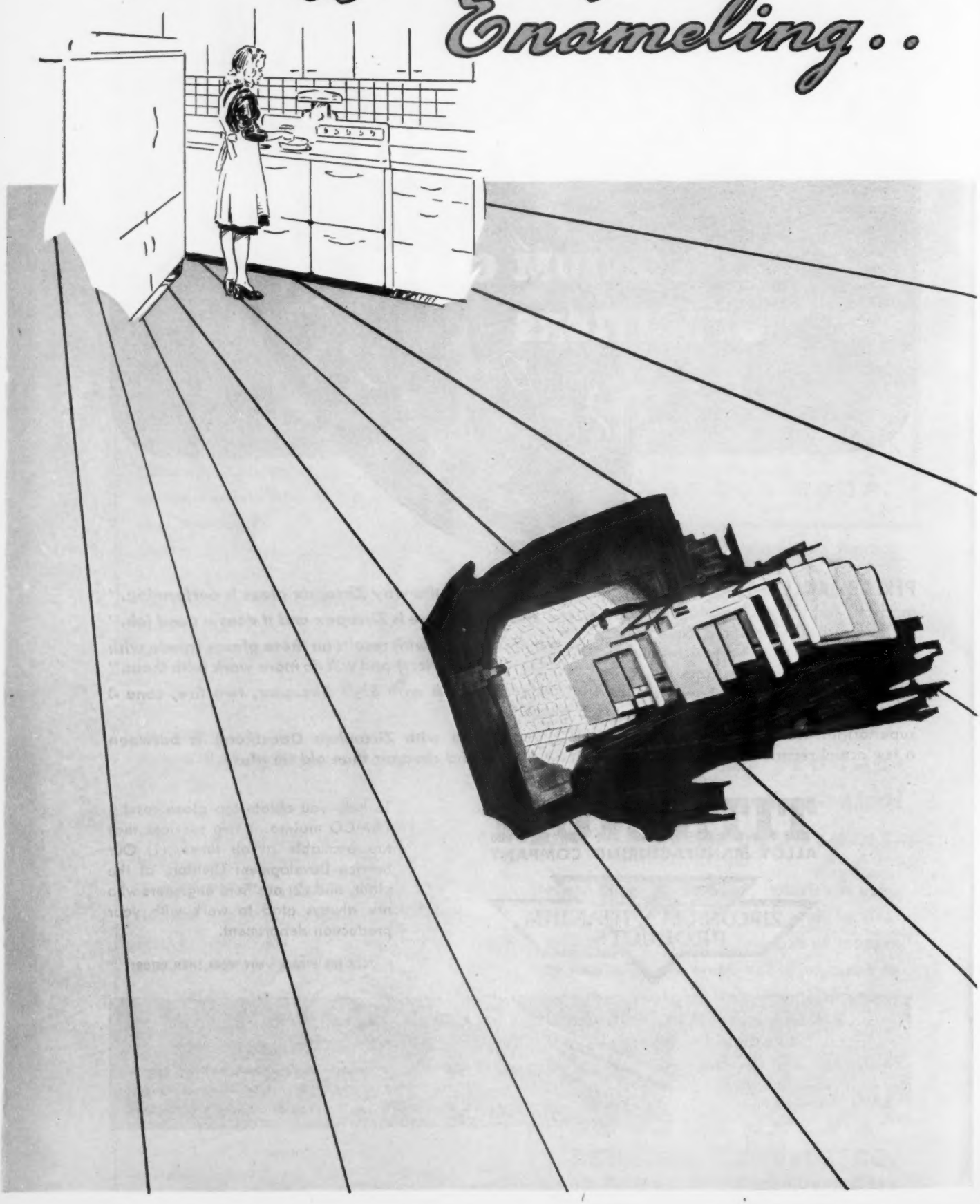

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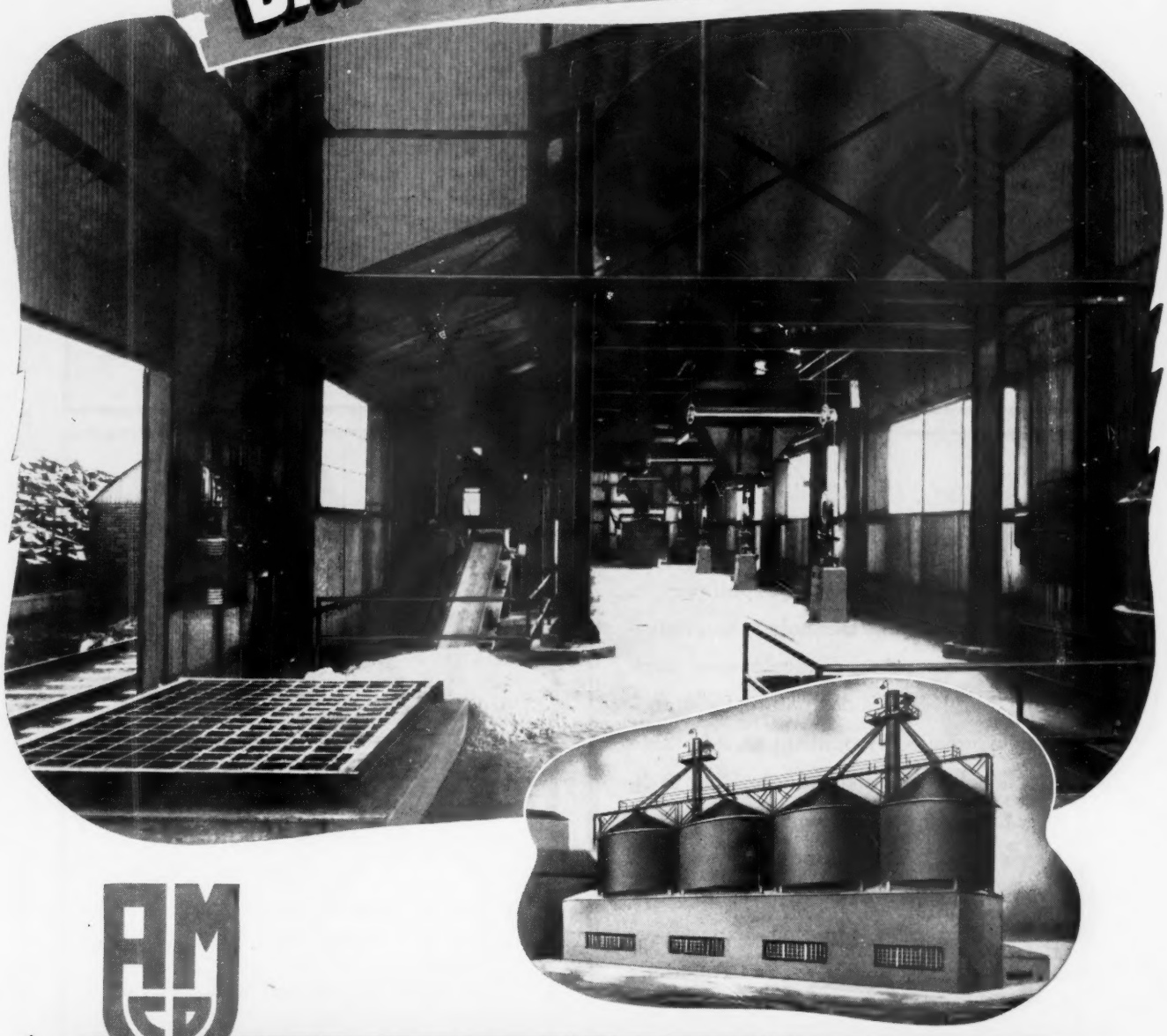

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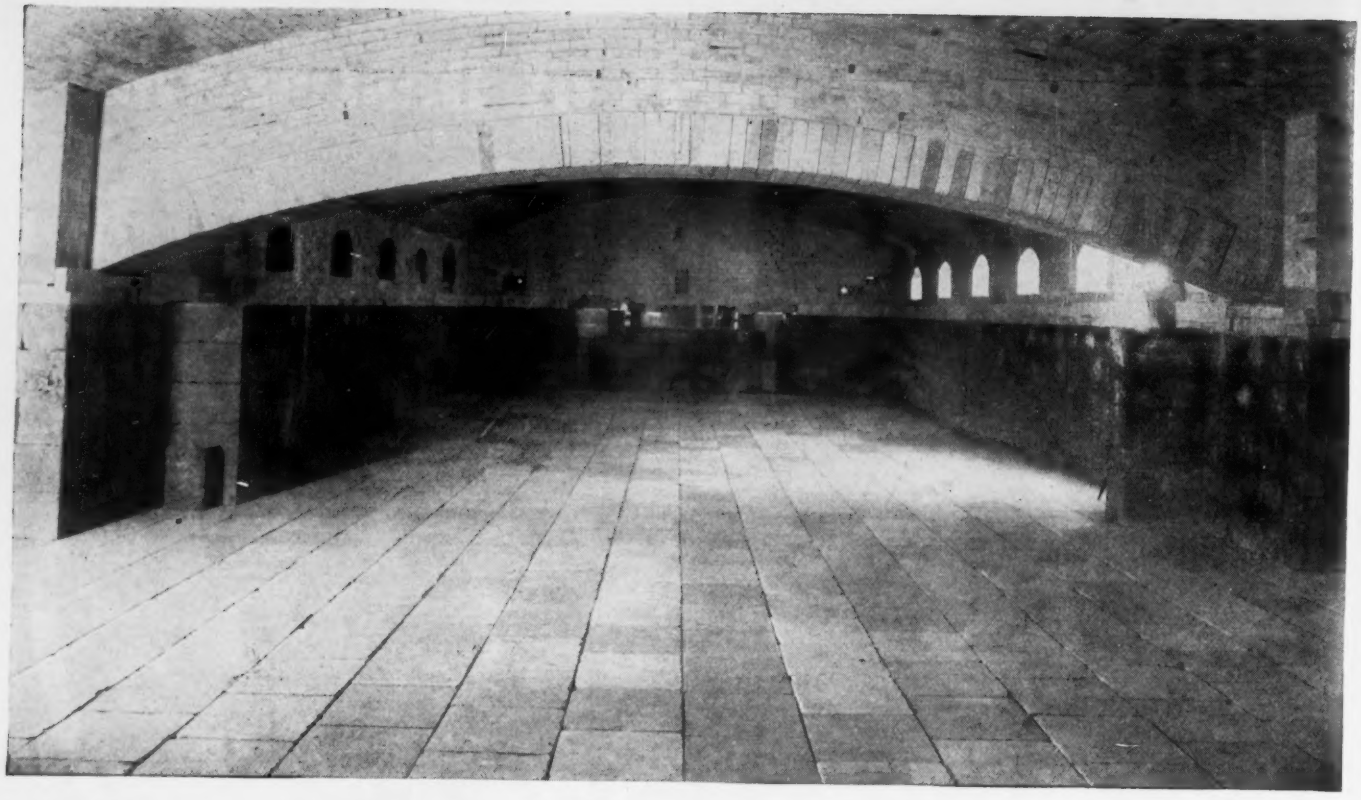

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PERIODICAL REFERENCE: The name of the periodical appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 23 **November 15, 1944** **No. 11**

Abrasives

Abrasive belts recoated. J. F. SIEFEN. *Iron Age*, **153** [14] 58–59 (1944).—Worn belts may be renovated by applying one coat of Brushing Nuglu—a mixture of cold glue and aluminum oxide grain. Results are claimed to be better than with original belts using hide glue. Techniques and coating machines are presented. E.H.McC.

Abrasive cut-off wheels—where and how to use them. F. A. UPPER. *Iron Age*, **150**, 48–51 (Sept. 10); 69–72 (Sept. 17, 1942); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 58A (1943).—U. discusses the cutting of metals with abrasive disks. The advantages of this method include the short time required for the cut, the clean surface left, accuracy attainable, and rapid cooling as compared with oxyacetylene cutting. Tables of data on wheel speeds and sizes, cutting times, and wheel life for wet- and dry-cutting of tubes, angles, and bars of nonferrous and ferrous metals are given. The merits of dry and wet cutting are compared.

Artificial abrasive industry. ANON. *Ind. Diamond Rev.*, **4** [45] 175–76 (1944).—The large wartime expansion of United Nations output is discussed. Canadian abrasive manufacturers and their location and products are given. Details are given for the years 1942, 1941, and 1938 on total artificial abrasives and products, number of firms, number of employees, salaries and wages, raw materials, fuel and electricity, capital invested, etc. P.G.

Fine engraving instrument. ANON. *Feinmech. & Präzision*, **51**, 81 (1943); abstracted in *Ind. Diamond Rev.*, **4** [45] 173–74 (1944).—An engraving instrument is described that does not make use of rotating cutters but instead scratches the marks into the material or etching ground with either a steel needle or a diamond. Three instruments are described in more detail: an engraving instrument in working position on a circular dividing machine, one for fine ciphers, and one with a base and universal rotary table. The instruments are produced by Georg Kesel K.G., Kempten, Germany. P.G.

Grinding high-speed steel tools. N. A. MALONE. *Steel*, **115** [2] 96–98, 114 (July 10, 1944).—The selection of the proper grade of grinding wheel as to type of abrasive and bond for a specific job is important. Vitrified and resinoid bonds are most predominant. Vitrified wheels are limited to wheel speeds under 6500 surface ft. per min., while resinoid wheels are capable of speeds up to 9500 surface ft. per min. or over. Coarse-grained resinoid wheels are best suited to removals involving heavy stock where finish is relatively unimportant. Vitrified wheels remove stock rapidly, hold their shape well, and are not affected by lubricating oils or water. The grade of a wheel is determined by the quantity of bond employed to hold the abrasive grain in position; the more bond, the harder is the wheel. M.A.S.

Manufactured abrasives, old and new. RAYMOND R. RIDGWAY. *Chem. & Eng. News*, **21** [11] 858–62 (1943).—R. relates the history of Al_2O_3 as an abrasive and describes its production from bauxite in the electric arc furnace. The impurities are reduced to metal by C, and the Al_2O_3 is concentrated. R. discusses the equilibrium with SiO_2 and TiO_2 and the relationship of purity, energy consumption, and melting point. He found the melting point of pure Al_2O_3 to be close to 2300°C. Al_2O_3 so produced has a purity of 94 to 95% or 96 to 97%, depending on the grade. Higher purity is obtained by using the Bayer process, and methods for still higher purity are indicated. The second abrasive discussed is B_4C, which is used as a lapping and polishing powder. It has a greater hardness than Al_2O_3 and SiC, being second only to diamond. It is also used in molded shapes as nozzles for sandblasting and as tips for test gauges. Its manufacture from boric acid is described. Its melting point is 2450°C.

F.G.H.

Morphological and structural crystallography and optical properties of silicon carbide: I, Morphological crystallography and etching figures. NEWMAN W. THIBAULT. *Amer. Mineralogist*, **29**, 249–78 (1944).—The morphological crystallography of β-SiC (cubic) and of five modifications or types of α-SiC (hexagonal), two of them new, is given in detail. Each of the α-SiC types is characterized by its own series of crystal forms; types I, IV, and VI have a rhombohedral lattice, while types II and III have a hexagonal lattice. Each type must be referred to its own axial ratio, all of which are rationally related. Two or more of the hexagonal modifications often coalesce in such a manner that the c and a axes are common and the basal pinacoids form the plane of contact. Two methods of twinning are noted. Crystal measurements made on

β-SiC for the first time indicate the hextetrahedral class of the isometric system. Beta-SiC is commonly intergrown with α-SiC. Etching figures obtained on α-SiC types by the use of Cl_2 at 1000°C. and by fused borax indicate that types I, IV, and VI are ditrigonal-pyramidal, and types II and III are dihexagonal-pyramidal. Etching phenomena reveal that purely morphological criteria are inadequate for the distinction between upper and lower basal pinacoids. W.D.F.

Physical, mechanical, and chemical properties of the diamond. ANON. *Ind. Diamond Rev.*, **4** [45] 167–68, 178–79 (1944).—The varieties of the diamond, their characteristics, and their chief uses are discussed, and a review of the crystal structure is given. The physical and chemical properties are discussed and given in a table that shows sixteen properties, with values, units, material of optimum value, alternative material, and persons by whom the property was investigated. In no less than twelve cases the diamond represents the optimum material available; in only four cases do slightly better materials exist, but even in these the diamond is always near the best material. A valuable list of references is included. P.G.

Roll grinding. T. SMITH. *Machine Shop Mag.*, **4**, 45–50 (Feb., 1943); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 161A (1943).—S. discusses the design of roll-grinding machines, the selection and care of grinding wheels, cooling agents, and wheel and traversing speeds.

Versatile metallographic polishing process. MILDRED FERGUSON. *Metal Progress*, **43** [5] 743–44 (1943); abstracted in *Jour. Iron & Steel Inst.* [London], **148** [2] 172A (1943).—An outline is given of the procedure at the Westinghouse research laboratories for polishing a wide variety of materials including carbon brushes, metals, and glass-metal seals. In one step of the procedure, ordinary paraffin disks (melting point 55°C.) and an abrasive suspended in soap solution are used.

SEPARATE PUBLICATION

Safe Installation and Use of Abrasive Wheels. *International Labour Office* [Montreal, Canada] *Studies and Repts.*, Ser. F, 2d Sect. (Safety), No. 9, 175 pp. (1944). Price $1.00. Distributed in the U. S. by the International Labour Office, 734 Jackson Place, Washington, D. C.—The rapid increase in the use of manufactured abrasive wheels and the production of artificial abrasives have been marked factors in modern industrial progress. At the end of the last century, grinding was practically limited to the production of cutting edges or sharp points mainly by means of ordinary grindstones, abrasive wheels made from the natural abrasives emery and corundum being used to a limited extent for the grinding of metal cutting tools. Now there is a vast and ever-widening field for grinding processes, not only in the making of cutlery and edge tools but in engineering, shipbuilding, steel manufacture, the textile industries, the marble, granite, glass, and glazed-tile trades, watch and clock making, various processes incidental to the making or finishing of boots and shoes, and even in the finishing of concrete buildings. The natural sandstone wheel or grindstone is still used for certain classes of work, but its use is steadily decreasing, and most grinding is now performed by the aid of manufactured abrasive wheels. Following the great increase in the number of abrasive wheels, the subject of the dangers incidental to their use has assumed increased importance. This monograph has therefore been prepared to direct attention to the causes of these dangers and to indicate various precautions which are necessary for safeguarding persons employed at grinding processes from (1) accidents and (2) damage to health through inhalation of dust.

Chapter 1 on the composition and manufacture of abrasive wheels is accurately but very inadequately given in five pages. Chapter 2 on accidents and injuries caused by abrasive wheels is limited to a one-page statement. Chapter 3 on safety precautions against accidents caused by bursting of wheels is very adequately presented, the data being given in both metric and English systems. Chapter 3 and Chapters 4 and 5 on precautions against accidents due to other causes fill fifty pages of text, data, and illustrations.

Appendix I, by Vitaliano Colombo, is devoted to a very clear analytical and experimental study of the conditions of resistance of abrasive wheels. Appendix II, by Thomas H. Frost and K. F. Whitcomb, is a discussion of stresses in rotating disks. Forty-five pages are devoted to these most thorough mathematical presentations.

Part II, covering more than eighty pages, gives the safety regulations in Germany, Great Britain, and the United States.

This treatise is a valuable book for both the producer and the user of grinding wheels. R.C.P.

PATENTS

Abrading apparatus. W. L. KEEFER (Pangborn Corp.). U. S. 2,359,313, Oct. 3, 1944 (June 12, 1942).—An abrasive throwing apparatus.

Abrading means and method of making. J. T. KELLEHER (one-half to American Optical Co. and one-half to Neveroil Bearing Co.). U. S. 2,358,459, Sept. 19, 1944 (April 26, 1943); divided out of 2,339,270, Jan. 18, 1944 (Nov. 28, 1940).—An abrading tool comprising abrasive particles substantially uniformly dispersed throughout a sintered mixture of approximately 40 to 50% nickel, 30 to 45% copper, and 10 to 20% tin. **U. S. 2,358,460,** Sept. 19, 1944 (April 26, 1943); divided out of U. S. 2,339,270, Jan. 18, 1944 (Nov. 28, 1940).—An abrading tool comprising abrasive particles substantially uniformly dispersed throughout at least a portion of a sintered mixture of approximately 75 to 90% cobalt and 10 to 25% copper.

Abrasive articles. A. ABBEY (Carborundum Co.). Brit. 563,556, Aug. 30, 1944 (Aug. 18, 1942).

Abrasive articles and methods for making. CARBORUNDUM CO. Brit. 562,851, Aug. 2, 1944 (Aug. 30, 1941). NORTON GRINDING WHEEL CO., LTD. Brit. 563,090, Aug. 10, 1944 (Jan. 22, 1942).

Abrasive belt for sanding steel. L. A. HATCH AND J. E. CLARKE (Minnesota Mining & Mfg. Co.). U. S. 2,357,823, Sept. 12, 1944 (Aug. 3, 1940).

Abrasive bodies bonded with synthetic resins. NORTON GRINDING WHEEL CO., LTD. Brit. 562,679, July 26, 1944 (Aug. 2, 1941). Brit. 563,123 and 563,124, Aug. 16, 1944 (Aug. 2, 1941).

Abrasive cutoff machine. H. G. ROBINSON (American Chain & Cable Co., Inc.). U. S. 2,358,880, Sept. 26, 1944 (March 17, 1941).

Abrasive implement. R. S. MANCHESTER (Behr-Manning Corp.). U. S. 2,358,724, Sept. 19, 1944 (Aug. 14, 1942).

Design for combined disk grinder and surfacer. A. J. BOWEN. U. S. 138,969, Oct. 3, 1944 (Sept. 23, 1943). U. S. 138,970 and 138,971, Oct. 3, 1944 (Oct. 22, 1943).

Device for sharpening or honing safety-razor blades. J. R. CLAYTON. Brit. 563,444, Aug. 30, 1944 (April 8, 1943).

Device for stropping or preserving a keen edge on razor blades. T. R. HINE. Brit. 563,697, Sept. 6, 1944 (April 30, 1943).

Dressing tool. S. R. ENBERG (Ainsworth Mfg. Co.). U. S. 2,359,411, Oct. 3, 1944 (Sept. 16, 1942).

Expansible honing tools. R. A. LISTER & CO., LTD., AND R. WERRETT. Brit. 562,659, July 26, 1944 (Jan. 6, 1943).

Fabric-backed abrasives. A. ABBEY (Carborundum Co.). Brit. 562,611, July 19, 1944 (March 31, 1942).

Gear-grinding apparatus. WESTINGHOUSE ELECTRIC INTERNATIONAL CO. Brit. 562,535, July 19, 1944 (March 25, 1942).

Grinder guard. PERCY BROWN. U. S. 2,358,959, Sept. 26, 1944 (May 15, 1944).

Grinding machine. A. D. MIZZY (Eleanor Mizzy). U. S. 2,358,584, Sept. 19, 1944 (June 2, 1942).—A grinding machine for hypodermic needles.

Grinding and polishing machines. P. LEVER AND A. T. JORDAN. Brit. 563,067, Aug. 10, 1944 (April 14, 1943).

Grinding wheel or other bonded abrasive articles. NORTON GRINDING WHEEL CO., LTD. Brit. 563,652, Sept. 6, 1944 (Dec. 6, 1941).

Jigs for use in grinding drill bits. C. CROFTON & Co. (Engineers), LTD., R. C. WILES, AND A. CAMERON. Brit. 563,546, Aug. 30, 1944 (March 18, 1943).

Means for honing or lapping cylindrical bores. D. TAYLOR. Brit. 563,199, Aug. 16, 1944 (Feb. 3, 1943).

Metal-supported abrasive articles. A. ABBEY (Carborundum Co.). Brit. 562,815, Aug. 2, 1944 (Jan. 13, 1943).

Method and apparatus for trimming form-grinder wheels. W. G. GREVE (Gear Grinding Machine Co.). U. S. 2,358,393, Sept. 19, 1944 (June 29, 1942).

Profile form-grinding machines or like shaping machines. J. F. PENNELL. Brit. 563,430, Aug. 30, 1944 (Nov. 25, 1942).

Safety-razor blade resharpener. P. ELLIOTT. Brit. 563,654, Sept. 6, 1944 (Jan. 18, 1943).

Sharpening of twist drills, etc. S. T. JEFFREYS AND E. H. JONES (Machine Tools), LTD. Brit. 563,292, Aug. 23, 1944 (Dec. 18, 1942).

Synthetic abrasive material. J. A. BROWN (Minnesota Mining & Mfg. Co.). U. S. 2,358,313, Sept. 19, 1944 (Feb. 23, 1940).—An abrasive grain comprising a fused or vitrified matrix having small-size particles disseminated therein, the small-size particles having a hardness substantially different from that of the matrix and being predominantly of a particle size not greater than approximately 100 microns.

Art and Archeology

Ceramic jewelry shows rapid development in California. ANON. *Ceram. Ind.*, **42** [5] 64–65 (1944).—Ceramic artists in California have turned to the manufacture of ceramic costume jewelry not affected by the critical-material restrictions. 3 illustrations. H.T.

Chinese porcelain in Ming dynasty. ANON. *Ceram. Age*, **42** [6] 220 (1943). F.G.H.

* **Fundamental physiological law of the perception of light stimuli.** M. BEREK. *Z. Instrumentenk.*, **63** [9] 297–309 (1943).—In a discussion of the theories and rules for expressing by a formula the magnitude of optic stimuli, B. develops a general formula for a numerical expression of the relation between sharpness of vision or angle of vision, brightness of the object, and brightness of the field surrounding the object. This formula takes the form $(B_i - B_u)\sigma^2 = (\sqrt{\phi} + \sigma\sqrt{B})^2$, where B_i = the brightness of the object, B_u = that of the surrounding field ($B_i > B_u$), σ = angle of vision, B = a function of the luminosity density ($\sqrt{B} = QB_u^q$), and ϕ = a function of the luminosity current, $\sqrt{\phi} = \log CB_u^c + PB_u^p$. If B is expressed in stilb and σ in minutes, the various coefficients have the following values: $C = 1.0479 \pm 0.0002$; $P = 0.50 \pm 0.07$; $Q = 0.058 \pm 0.002$; $c = 0.00208 \pm 0.00001$; $p = 0.52 \pm 0.03$; $q = 0.412 \pm 0.006$. For a "lightless" surrounding field, B_u assumes the value $10^{-9.1}$ stilb. Tables for the values of the functions $\sqrt{\phi}$ and $\sqrt{B}$ are added, and it is shown that the formulas of Piper, Weber-Fechner, Ricco, and others are special cases of the developed general formula. M.HA.

John Goodwin, pioneer potter. ANON. *Bull. Amer. Ceram. Soc.*, **23** [10] 393 (1944); see *ibid.*, **21** [11] 241–47 (1942).

Making photographic objectives. E. W. MELSON. *Ceram. Age*, **42** [5] 167–71, 187 (1943).—Each step in the production of photographic objectives is briefly described. Illustrated. F.G.H.

New processes in decoration. F. DEARDEN. *Trans. Brit. Ceram. Soc.*, **43** [4] 68–73 (1944).—The future developments in the reproduction of ceramic transfers will be in the methods employed in producing the printing image. The two processes that are of considerable interest at present are (1) photolithography and (2) the silk-screen process. Both are described. R.A.H.

Products design, a key to better living. D. L. HADLEY. *Bull. Amer. Ceram. Soc.*, **23** [10] 388–89 (1944).

Rowantrees Pottery of Blue Hill, Maine. ANON. *Ceram. Age*, **42** [5] 175 (1943).—The production of wheel-thrown pottery, chiefly tableware, by this cooperative organization is briefly described. Illustrated. F.G.H.

* From microfilm.

BOOK

Company Museums. LAURANCE VAIL COLEMAN. American Assn. of Museums, Washington, D. C., 1943. 174 pp. Price $2.50. Reviewed in *Chem. & Eng. News*, **21** [19] 1648 (1943). F.G.H.

PATENTS

Decalcomania. M. E. WYSONG (Gladys H. Wysong). U. S. 2,359,185, Sept. 26, 1944 (Aug. 15, 1940); divided out of U. S. 2,355,333, Nov. 30, 1943 (July 14, 1939).

Decalcomania. B. C. BRICKER (E. I. du Pont de Nemours & Co.). U. S. 2,359,462, Oct. 3, 1944 (Sept. 21, 1942).—A ceramic decalcomania for use in applying a multicolor design in vitrifiable enamel colors to the surface of ceramic ware which comprises a backing member, an impression-receiving layer secured to the backing member, and a plurality of successively overlapping vitrifiable colors constituting the design contained on the impression-receiving layer, the colors each comprising a pigment and a frit, each color having the desired hue and depth and a fusing temperature higher than the color preceding it in the order in which the colors of the decalcomania will be positioned on the ceramic ware, the hue and depth and the fusing temperature of each color being determined by the proportion and composition of the frit contained therein, the composition of the frit of at least some of the colors differing from the composition of the frit of another color or colors.

Photographic process for etching figures on glass. J. V. SIGFORD AND W. H. KLIEVER (Minneapolis-Honeywell Regulator Co.). U. S. 2,357,913, Sept. 12, 1944 (Aug. 29, 1941).—A process for photographically applying an image to an article of glass or similar material comprising successively applying a plurality of layers of silver coating to the article until the metallic surface has a slightly white appearance, successively applying a plurality of layers of light-sensitive coating to the silver coating until the coating has assumed a thickness substantially equal to one-half the wave length of red light, projecting an image of the desired configuration upon the light-sensitive coating, and then developing the coating to remove that portion of the light-sensitive coating conforming to the configuration of the image projected thereon.

Cements

Molds and model—show to make and care for them. ANON. *Ceram. Ind.*, **43** [2] 64–68 (1944).—The fundamental principles of making pottery molds are reviewed. 8 illustrations. H.T.

Organic dyestuffs as cement colors. R. B. FORSTER, K. G. KUDVA, AND K. VENKATARAMAN. *Jour. Indian Chem. Soc., Ind. & News Ed.*, No. 2 (1943); abstracted in *Chem. Trade Jour.*, **114** [2957] 79 (1944).—The quinoneoxime lakes of naphthol AS and naphthol AS-GR are the best dyes for colored cements. L.R.B.

Vertical limekiln problems. R. W. ROTHROCK. *Pit & Quarry*, **37** [2] 64–65 (1944).—R. discusses the problems connected with the recording of important factors relative to combustion, draft, and temperature in vertical limekilns and gives data on some existing instrument installations. 1 diagram, 4 photographs. M.R.

Why not better plaster molds? FRED H. BAILEY. *Ceram. Age*, **42** [2] 51–52 (1943).—B. considers mold production in progressive steps as follows: (1) if the model is not right, then all its imperfections will be carried to the block mold; (2) if the block mold is not as perfect as possible, the case will surely have the same imperfections; (3) such case troubles will be passed along to the production mold; and (4) the production mold will of necessity bring its accumulated defects to the ware. Each step is distinct in itself and accordingly must be watched and handled closely to eliminate trouble. Regardless of the production problem, the fault can usually be traced to something wrong from the model to the production mold. Illustrated. F.G.H.

PATENTS

Manufacture of plaster of Paris. C. L. HADDON, B. J. CAFFERATA, AND BRITISH PLASTER BOARD, LTD. Brit. 563,019, Aug. 10, 1944 (Dec. 21, 1942).

Enamel

Application of low pH cleaning to porcelain enameling. B. F. LEWIS. *Finish*, **1** [5] 20–22, 44 (1944).—The use of a cleaner bath of pH 7 to 8, preceding the usual alkali and acid baths, has been practiced as preparation for the electroplating of metal for six years and has recently been applied in porcelain enameling. While the pH of the new bath is very close to the neutral point, with respect to cleaning it exhibits the characteristics of both alkaline and acid baths but without the evolution of hydrogen. It is extremely effective in its reaction with surface oil and grease of all types and in addition reacts with iron oxide in the form of red rust or temper colors. On longer immersion, the steel itself is attacked, thus offering the possibility that acid pickling may be dispensed with. Advantages claimed for the low-high process include (1) ready removal of sheep-wool fat, which is merely "set" by the usual process, (2) elimination of the necessity of using highly caustic components with their accompanying industrial hazards, (3) reduction of the processing time, and (4) reduction of the possibility of hydrogen absorption into the ware because of the shorter time and lower temperature in the acid pickle. L. also discusses findings with respect to bright pickling in which the metal surface is freed entirely from oxides and pickling smut. A white mat surface is preferable to a bright smooth surface, and a moderately passive surface is conducive to better bonding because of the lesser tendency to oxidize excessively in firing. The pickling operation may be controlled to produce various conditions of surface activity with respect to oxidation during firing. V.D.F.

Canned heat for Berlin-Tokyo. HAROLD B. GRAY. *Finish*, **1** [4] 13–16 (1944).—The manufacture of incendiary bomb elements by one porcelain enameling plant includes the casting of magnesium casings and their heat-treating, pickling, and machining. 5 illustrations. V.D.F.

Does your product have a career in the movies? A. B. LAING. *Enamelist*, **21** [7] 18–19 (1944).—The appearance of porcelain enameled products in Hollywood films has resulted in new trends in consumer demands. Hollywood is now one of the largest single users of porcelain enameled ware for "prop" use. V.D.F.

Electrolytic cleaning of steel in molten caustic soda. N. L. EVANS. *Foundry Trade Jour.*, **73** [1449] 68 (1944).—The process consists of immersion for 15 sec. in a bath at 454°C. with a current density of 100 amp. per sq. ft. Advantages claimed for the process include a cleaner surface for enameling, no embrittlement through hydrogen absorption, and no rusting during storage between cleaning and the next process. A study of the mechanism of pickling in molten caustic soda and a description of the laboratory experiment are included, and the design of plant for carrying out the process, which is known as "bethanizing," is indicated. A.B.

Enamel Institute campaigns for big postwar market. ANON. *Ceram. Ind.*, **43** [1] 54–56 (1944).—Report on a meeting of the Porcelain Enamel Institute, June, 1944, in Cleveland, Ohio. H.T.

Gas pickling of steel. ANON. *Ceram. Ind.*, **42** [5] 50–53 (1944).—By the gas pickling process, oxides present on steel are converted into vaporized chlorides through reaction with hydrogen chloride gas at elevated temperatures. While the process has not been used commercially in enameling, samples have proved superior to conventional acid-pickled metals. 13 illustrations. H.T.

History of porcelain enameling: I. ANON. *Enamelist*, **21** [8] 35–36 (1944).—The origin of enameling as an ornamental art is discussed. **II.** *Ibid.*, [9] 38–41.—Evidence of early enameling art in Greece Etruria and France is described. **III, Early cloisonné enamels.** *Ibid.*, [10] 48–50. **IV, Mixed types of enamels.** *Ibid.*, [11] 42–43. V.D.F.

How and why of sign advertising: I, Introduction; II, Uses of sign advertising. KEN M. DAVEE. *Finish*, **1** [4] 9–12; [5] 17–19, 39–40 (1944).—Sign advertising constitutes a significant proportion of all advertising and is evidently a most effective form. To find why signs are used and how to use them best, surveys were made to obtain the results of experience of large sign users and advertising authorities. The findings of the survey are discussed under a classification of signs by uses. **VI, Laying out an effective sign.** *Ibid.*, [9] 20–23.—The following factors are discussed: size, contrast, motion as a means of attracting attention, dominant or unusual brightness, style of lettering, color contrast, other uses of color, illumination, simplicity, etc. **VII, Selecting the sign material.** *Ibid.*, [10] 20–23.—Factors to be considered in selecting the sign material are as follows: (1) How long is the sign likely to be in service? (2) What effect is desired? (3) Do your reproductions require colors and design difficult to reproduce and hold? (4) Will it be exposed to salt sea air in the coast cities? (5) Will it be used where it will collect grime? (6) Will it be exposed to constant abrasion and vibration? (7) Will it be subject to rough handling? (8) How will your sign be hung? (9) What quantity of signs can be bought in a single order? These subjects are thoroughly discussed. See *Ceram. Abs.*, **23** [10] 166 (1944). V.D.F. & W.R.B.

Ideal postwar enamel plant for cast iron. F. M. BURT. *Ceram. Ind.*, **43** [2] 47–49; [3] 58–60 (1944).—An imaginary ideal plant with a minimum of heavy manual labor and good working conditions is described. 4 illustrations. H.T.

Kitchen planning. VIRGINIA HART. *Finish*, **1** [9] 26–28 (1944).—A timely discourse on the planning of modern kitchens is presented. W.R.B.

Mechanism of corrosion processes. R. M. BURNS. *Sheet Metal Inds.*, **19,** 815–19 (May, 1944).—B. discusses the electrochemical nature of corrosion, the formation of protective films, and their influence on later processes. A.B.

Metal coloring finishes. H. SILMAN. *Sheet Metal Inds.*, **19,** 653–62 (April); 841–51 (May, 1944).—S. discusses the treatment of sheet steel by immersion, spraying, or heating to produce decorative and protective coatings. A.B.

Modern wire-enameling equipment. O. S. HASKELL. *Wire & Wire Products*, **17,** 447–50, 476–77 (Sept., 1942); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 93A (1943).—H. describes and illustrates machinery and equipment in the wire department of the General Electric Co., Schenectady, for the enameling of wire from 8 gauge down to sizes smaller than 40 gauge.

Permanence of porcelain protection against corrosion. C. J. RODMAN. *Finish*, **1** [10] 17–19 (1944).—R. gives a brief account, including some history, of the durability of

porcelain enamels. Possibilities of porcelain enameled caskets and coffins are discussed. W.R.B.

Porcelain enamel in the postwar electrical appliance industry. J. C. SHARP. *Finish*, **1** [10] 13–16 (1944).—The development of the modern electric range is traced, its advantages and limitations are discussed, and its design is studied. Future kitchen layouts are pictured. W.R.B.

Porcelain enamel for safety and operations on a public utility system. HENRY C. RUHL. *Enamelist*, **21** [6] 12–16 (1944).—The choice of porcelain enamel for a sign material to mark the vital equipment of the Philadelphia Electric Co. was made on the basis of careful comparison with other materials. The process of manufacturing the signs in a small-scale plant set up for the purpose is described. V.D.F.

Porcelain enameled highway signs and markers last longer. J. T. PENTON. *Enamelist*, **21** [7] 16–17, 49–51 (1944).—The two automobile clubs of the State of California have standardized on porcelain enameled highway signs on the basis of thirty years' experience with them. P. answers five common questions: (1) The first cost of porcelain enameled signs is less than that of painted stamped-metal signs because of the wide variety of special designs, many of them required in small number, and because of the necessity for frequent revision of sign needs which calls for constant reordering in small lots. (2) The life of porcelain enameled signs in the Californian climate (ranging from desert heat to mountain snows and seaside salt spray) averaged better than 15 years according to the records of one association, while the other found an average yearly loss of 2% of the signs in place. (3) Other states do not use porcelain enameled signs because the expensive painted stamped-metal signs can be produced in their own shops, giving employment to more men. It is also frequently necessary to produce their own because of the reluctance of manufacturers to undertake the responsibility for this detailed and exacting job. (4) Other porcelain enameling plants have not entered the field because of lack of experience and understanding, but P. believes that others could undertake it profitably and offers all necessary information to those interested. (5) No substitute for porcelain enamel in this application can be considered its equal. V.D.F.

Porcelain enameled hot-water tank. D. R. GOETCHIUS. *Enamelist*, **21** [11] 6–8 (1944).—Laboratory tests and service in the field have proved the porcelain enameled hot-water tank highly satisfactory. Special methods of enamel application, necessitated by the unusual shape and the rigid requirements for uniform thickness, include the use of the spray-flow principle and the barrel gun, while consideration is being given to centrifugal spraying machines and electrostatic spraying. Contrary to expectation, pickling has given better results than sandblasting. The box furnaces so far used are difficult to fire without warpage of the ware. Vertical placement of the tanks helps to remedy warpage but requires a very high furnace with good circulation and uniform temperature. The possibility of continuous furnaces and heating by the induction principle is discussed. Since visual inspection is inadequate for detecting fine pinholes, electrical methods have been developed. V.D.F.

Porosity in light castings. C. A. PAYNE. *Foundry Trade Jour.*, **73** [1447] 23–29 (1944).—P. discusses the influence of the design of the casting and the effect of metalloids on the porosity of the casting; the effect of occluded gases and of variations in metal condition due to excessive oxidation of the melt; and the detrimental effect of hydrogen. A.B.

Postwar home laundry equipment. JOHN M. WICHT. *Finish*, **1** [9] 16–19 (1944).—W. presents an article for the manufacturer on plans and developments for future laundry design and equipment. W.R.B.

Practical application of enamel decoration. HAROLD TISHLER. *Finish*, **1** [9] 14–15 (1944).—T. discusses the possibilities of vitreous enamel decoration for homes, particularly in kitchen and bath, built-in decorative art, and furniture ensembles. W.R.B.

Problems of degreasing and cleaning. H. SILMAN. *Sheet Metal Inds.*, (Dec., 1943); 309–17 (Feb., 1944); 467–73 (March, 1944).—Alkaline cleaners and the effects of surface tension and wetting agents on the cleaning efficiency are discussed. Testing methods and the layout of cleaning plants for batch and conveyer systems are outlined. A.B.

Refresher course for porcelain enamelers: II, Development of porcelain enameling furnaces and refractories. Edited by J. E. HANSEN. *Enamelist*, **21** [5] 17–19, 28–36 (1944). **III, Testing of porcelain enameling furnaces.** *Ibid.*, [6] 23–43. **IV, Enamel mill room practice.** *Ibid.*, [7] 34–41. **V, Mill additions.** *Ibid.*, [8] 23–31, 55–61. **VI, Water and air supplies for porcelain enameling plants.** *Ibid.*, [9] 19–25, 53–55. **VII, Preparation of metal surfaces.** *Ibid.*, [10] 15–24, 59–61. **VIII, Application, drying, and brushing of porcelain enamel.** *Ibid.*, [11] 9–15, 57–62. For Part I see "Design . . . ," *Ceram. Abs.*, **23** [4] 69 (1944). V.D.F.

Report on new design for metal flue. ANON. *Enamelist*, **21** [10] 5–8 (1944).—A new all-metal flue in which a dangerous excess of heat is removed by a moving column of cold air circulating in a ventilation space between the liner and an outer shell was developed by the Porcelain Enamel Institute. The new flue passed the fire-hazard test at the National Bureau of Standards and offers a solution to the trouble experienced with the present design of porcelain enameled insulated metal chimneys used on FHA projects. 1 figure. V.D.F.

Report on porcelain enamel and the building code. EDWARD MACKASEK. *Enamelist*, **21** [7] 20–23 (1944).—Nation-wide recognition of porcelain enamel as a building material is hampered by the large number of obsolete local building codes. The 2000 different codes in use are often conflicting and add expense to the cost of testing building materials. The Building Officials Conference of America is working to bring codes up to date and to simplify them by working out regional codes for the larger geographical areas. The porcelain enameling industry is urged to initiate a campaign to furnish building officials and code authorities with the facts about its product. The Porcelain Enamel Institute has already done good work in this direction. Attention must also be given to materials accessory to the use of porcelain enamel in building installations. V.D.F.

Stove manufacturers consider reconversion. ANON. *Ceram. Ind.*, **43** [1] 52–53 (1944).—Report of the meeting of the Institute of Cooking and Heating Appliance Manufacturers, June, 1944, at Cincinnati, Ohio. H.T.

230 million dollars worth of production for enameling plants. REXFORD NEWCOMB, JR. *Finish*, **1** [5] 9–12, 42 (1944).—An analysis of the probable yearly postwar demand for each specific type of enameled ware is presented.

	1939	1943	V+
Signs	$ 3,849,122	$ 241,201	$ 4,500,000
Architectural parts	1,794,729	*	3,500,000
Stoves and ranges	53,230,151	7,651,000	60,000,000
Refrigerators	40,752,525	651,000	82,000,000
Washing machines	3,454,284	*	7,000,000
Plumbing ware	43,357,286	4,184,678	48,000,000
Kitchen and hospital ware	15,139,744	21,545,000	15,000,000
Table tops and drainboards	4,070,896	*	5,000,000
Reflectors	1,835,572	5,061,897	2,000,000
All other	3,425,539	4,233,499	3,500,000
Total	$170,909,848	$43,568,275	$230,500,000

* Included in "all other" to avoid disclosure of individual operations.

V.D.F.

Use of wetting agents in degreasing sheet steel. P. M. FISK AND F. F. POLLARD. *Sheet Metal Inds.*, **19**, 427 (March, 1944).—A brief account is given of experiments with various alkaline detergents to remove mineral oils from sheet-metal shapes as a preliminary to the finishing process. A.B.

War alloys to improve enamel burning fixtures. ANON. *Ceram. Ind.*, **43** [1] 57–58 (1944). H.T.

PATENTS

Enameled structures. MORLEY PRODUCTS (Padiham), LTD., AND H. MORLEY. Brit. 563,100, Aug. 10, 1944 (April 17, 1943).

Making enamelware. W. J. BALDWIN (Homelaya, Inc.). U. S. 2,359,283, Oct. 3, 1944 (April 12, 1939; Feb. 13, 1942).—The method herein described of producing a metal article having a vitrified coating with a crinkle finish which comprises applying to the metal article a vitrifiable coating compound that contains a frit of usual composition including cryolite and which frit also includes unreacted antimony trioxide, firing the article so coated in an oxidizing atmosphere to vitrify the coating and under conditions which preserve in the finished coating some unreacted antimony trioxide, and cooling the ware after firing.

Glass

Analysis of batch for segregation. H. J. HUNT. *Jour. Amer. Ceram. Soc.*, **27** [10] 305–308 (1944).—2 references.

Courts rule for and against glass manufacturers. ANON. *Ceram. Ind.*, **43** [1] 49–50 (1944).—Decisions in several recent suits against ceramic manufacturers are cited. H.T.

Dow Corning announces commercial availability of silicones. ANON. *Bull. Amer. Ceram. Soc.*, **23** [10] 396 (1944).

*** Effect of thermal expansion on the absorption spectrum of insulators.** F. MÖGLICH AND R. ROMPE. *Z. Physik*, **119** [7/8] 472–81 (1942).—It is shown that in solid insulators (glass, quartz, etc.) higher temperatures cause changes in the absorption and therefore also in the emission spectrum and that the thermal expansion of the lattice causes a shift toward longer wave lengths. The effect is proportional to the temperature and the thermal expansion coefficient. M.Ha.

Fuels affect glass-tank design. ANON. *Ceram. Ind.*, **43** [1] 46–48 (1944).—Correct interpretation of the data secured from control instruments will increase the efficiency of glass-tank operation. Economy can be achieved by better correlation between pull on tank, size of tank, and glass formula. 5 illustrations. H.T.

Fume or vapors from molten glasses. C. A. BRADLEY, JR. *Bull. Amer. Ceram. Soc.*, **23** [10] 379–81 (1944).—4 references.

Improvements in optical glass. E. W. MELSON. *Ceram. Age*, **42** [3] 97–98 (1943).—M. describes methods of treating lens surfaces to reduce reflection and increase light transmission. Illustrated. F.G.H.

Key to postwar glass-container markets. EDWARD J. DETGEN. *Ceram. Age*, **42** [5] 182–84 (1943).—On the basis of past relationships between glass containers and the "gross national product," D. computes potential postwar glass-container markets. Illustrated. See "Place . . .," *Ceram. Abs.*, **23** [2] 48 (1944). F.G.H.

Looking into the future with glass. ANON. *Ceram. Ind.*, **42** [5] 58, 60 (1944).—Glass has a bright future for the postwar home. Glass fiber has possibilities not yet explored. Farm markets for glass present new sales opportunities. H.T.

Modern methods of producing plate glass and a comparison with steel production. H. JEBSEN-MARWEDEL. *Stahl & Eisen*, **62**, 858–63 (Oct. 8, 1942); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 47A (1943).—After describing two modern methods of manufacturing plate glass, the author presents and discusses data relative to the size, capacity, melting time, heat consumption, and refractory-brick consumption of glass furnaces and open-hearth steel furnaces.

Processing of glass in the lamp and radio-valve industries. R. L. BREADNER AND C. H. SIMMS. *G.E.C. Jour.*, **12** [4] 192–208 (1943).—Following a clear account of the physics of glass, especially thermal stresses, illustrated by a wide range of glasses, the following topics are treated: (1) Glass to metal joints. The differential stress is reduced by matching the thermal expansion or by using a ductile metal, such as copper, which is distorted by stresses below the yield point of the glass. Rods, disks, or tubes of metal may be sealed to glass, the seal being assisted by such a thickness of metal oxide film as will leave a pale color in the glass when cold. The joints are designed to leave the glass in slight compression. (2) The design of glassworking machinery. (3) Glass cutters. (4) Burners and torches. (5) Annealing lehrs; a lehr built from a 6 ft. x 4 in. heavy brass tube, gas-heated over half its length, is described for small glass articles. (6) Mechanized glassworking processes. (7) Future developments. L.R.B.

Production of glass containers now at record high. ANON. *Ceram. Ind.*, **43** [2] 50–52 (1944).—A report of the annual meeting of the Glass Container Assn. in New York, June, 1944. H.T.

Properties of some Vycor-brand glasses. MARTIN E. NORDBERG. *Jour. Amer. Ceram. Soc.*, **27** [10] 299–305 (1944).—10 references, 6 illustrations.

Suggestions concerning pots in hand plants. AXEL OTTOSON AND C. J. UHRMANN. *Bull. Amer. Ceram. Soc.*, **23** [10] 385–87 (1944).—1 figure.

Thermal problems in illuminating engineering. W. R. STEVENS. *G.E.C. Jour.*, **12** [4] 177–86 (1943).—The heat emitted by electric lights raises the temperature of (1) the surroundings and bystanders and (2) the fittings and cables. In special cases under 1, heat may be removed by one or more thicknesses of heat-absorbing glass (such as Calorex) which, unlike soda glass, absorbs strongly in the region from 0.5 to 2.5 μ, corresponding closely to the region of maximum absorption of the tungsten-filament lamp. Hot glass lamp shades are tested for thermal endurance by British Standard Specification Test No. 324. Exterior fittings are subjected while alight to artificial rain equivalent to 40 in. per hr. L.R.B.

PATENTS

Gas-tight seals wherein electric conductors pass through quartz and like vitreous material. GENERAL ELECTRIC CO., LTD., AND K. G. SCHNETZLER. Brit. 512,257, Sept. 20, 1939 (March 23, 1938). Brit. 513,025, Oct. 11, 1939 (March 23, 1938); divided out of Brit. 512,257. GENERAL ELECTRIC CO., LTD., AND E. H. NELSON. Brit. 563,027, Aug. 10, 1944 (Jan. 20, 1943); addition to 513,025.

Glassworking apparatus. H. H. BLAU AND R. W. KELL (Corning Glass Works). U. S. 2,357,993, Sept. 12, 1944 (March 7, 1940; Feb. 26, 1941).

Manufacture of tempered glass. SUNTEX SAFETY GLASS INDUSTRIES, LTD., AND H. GLASER. Brit. 563,138, Aug. 16, 1944 (Jan. 26, 1943).

Means or apparatus for improving the durability of glass containers. UNITED GLASS BOTTLE MANUFACTURERS, LTD., E. SEDDON, AND T. C. MOORSHEAD, JR. Brit. 563,091, Aug. 10, 1944 (Jan. 25, 1943).

Means for tempering glass articles. H. R. KIEHL AND W. W. SHAVER (Corning Glass Works). U. S. 2,359,222, Sept. 26, 1944 (Aug. 3, 1940; March 1, 1941).

Method and apparatus for manufacturing mineral wool. J. H. ZETTEL (Johns-Manville Corp.). U. S. 2,358,900, Sept. 26, 1944 (Oct. 10, 1944).

Minus green filter glass. H. H. BLAU (Corning Glass Works). U. S. 2,357,994, Sept. 12, 1944 (Oct. 6, 1941).—A minus green glass having a low transmission for green light and a relatively high transmission for the remainder of the visible spectrum which consists of approximately 49 SiO_2, 15 K_2O, 36 PbO, 0.08 MnO_2, and 0.002% Cr_2O_3.

Production of articles of glass having reduced transparency and great refractive power. AKTIEBOLAGET ORREFORS GLASBRUK. Brit. 563,658, Sept. 6, 1944 (Feb. 2, 1942).

Providing a mat finish upon polished glass surfaces.

* From microfilm.

F. W. ADAMS (Pittsburgh Plate Glass Co.). U. S. 2,359,072, Sept. 26, 1944 (March 13, 1943).—A process of etching glass to obtain a mat surface which comprises coating the surface with a solution of an organic plastic containing dispersed particles of inorganic pigment insoluble in the solvent for the plastic, the pigment being soluble in solvents which are nonsolvents for the plastic, the plastic further being insoluble in hydrofluoric acid etching baths, evaporating the solvent for the plastic to leave a solid film of plastic containing dispersed particles of pigment, dissolving out the particles of pigment with a nonsolvent for the plastic, and etching the points in the surface thus exposed with hydrogen fluoride.

Vitreous electrical device and its fabrication. R. A. KUEBLER (General Electric Co.). U. S. 2,359,483, Oct. 3, 1944 (Oct. 17, 1942).

Wicks and glass-fiber threads or fabrics. H. H. GOLDSTAUB. Brit. 563,050, Aug. 10, 1944 (Jan. 5, 1943).

Structural Clay Products

Clay tile for floors and walls. *Nat. Bur. Standards Simplified Practice Recommendation*, R61–44; abstracted in *Bull. Amer. Ceram. Soc.*, **23** [10] 395–96 (1944).—This revision of R61–30 is effective September 1, 1944.

*** Formula for determining the strength of brick walls.** M. HERRMANN. *Tonind.-Ztg.*, **67** [11/12] 91–94 (1943).—The strength can be calculated from the formula $e = t\sqrt[3]{m \times s^2}$, where e = strength of the wall, s = the strength of the brick, m = the strength of the mortar, and t = a coefficient for which curves are given. Curves for s and m are also given. M.HA.

Modular masonry. HARRY C. PLUMMER AND E. F. WANNER. *Bull. Amer. Ceram. Soc.*, **23** [10] 382–84 (1944).—2 references.

* From microfilm.

Refractories

Alumina from andalusite. ANON. *Anglo-Swedish Rev.*, (Jan., 1944); abstracted in *Chem. Trade Jour.*, **114** [2958] 94 (1944).—Alumina has been made for the past two years at Sundsvall, Sweden, from andalusite. The latter is smelted with limestone in an electric furnace, giving calcium aluminate. This is converted to the sodium salt, which is decomposed with CO_2, precipitating hydrated alumina, the soda being recoverable. The alumina is calcined with generator gas in a rotary kiln. Four thousand tons of aluminum per annum is produced. L.R.B.

Alumina from clay by the lime-sinter method. F. R. ARCHIBALD AND C. F. JACKSON. *Amer. Inst. Mining Met. Engrs. Tech. Pub.*, No. 1706; *Metals Tech.*, **11** [5] 12 pp. (1944).—This method is named the Ancor process and is to be tested in a plant now being built at Harleyville, S. C. It will use a kaolin clay from South Carolina and is designed to produce 50 tons of calcined alumina per day. The steps are (1) preparation of raw materials, (2) furnacing, (3) leaching, (4) purification of solution, (5) recovery of alumina, and (6) calcination. (1) The clay is washed well to remove sand, as each pound of SiO_2 takes 3.3 lb. of $CaCO_3$. Small amounts of magnesia are harmful, but a little iron and titania merely help the fluxing. The limestone used is friable and requires little crushing. (2) A rotary kiln is used at a temperature of 2400° to 2500°F., and time of contact is about an hour. $2CaO \cdot SiO_2$ is formed, and this should decrepitate on cooling. (3) Leaching uses 2 moles of Na_2O to 1 mole of Al_2O_3 for 20 min. at 158°F. and removes 83% of the alumina when there are 85 gm. of Al_2O_3 per liter. (4) Silica in the solution is precipitated. (5 and 6) The alumina hydrate is precipitated by seeding and carbonation; further handling is done by old methods. The by-product, dicalcium silicate, is a valuable raw material for Portland cement. The cost will vary between wide limits and is only economically sound where clay and limestone are close together and of the proper grade. W.D.F.

Alumino-silicate refractories. J. H. CHESTERS. *Iron Age*, **153** [23] 48–53; [24] 79–85 (1944).—C. discusses minerals suitable for fire-clay brick and considers their reactions with various oxides. Fire clays are widely distributed. Normal firebrick has an alumina content of 33 to 38%, but siliceous brick with only 22% are used. In Great Britain few brick are made in the range between 42% and 60 to 70% alumina; in America, diaspore clays permit a continuous range of products. Blended clays are used with a content of grog as high as 90% (usually 10 to 25%). Manufacture is discussed briefly. Cold crushing strength may be increased by harder firing, but this may lead to low thermal-shock resistance. X-ray examination reveals both the type of refractory and the firing treatment. An aluminosilicate cement should not be used to set brick outside this range. E.H.McC.

Basic-lined ladles for desulfurization of cast iron. N. L. EVANS. Presented at meeting of the Iron and Steel Institute [London]; abstracted in *Ind. Heating*, **11** [4] 626, 628 (1944); *Foundry Trade Jour.*, **72** [1430] 25–30 (1944). M.HA. & A.B.

Carbon refractories for blast furnaces. JOSEF M. ROBITSCHEK. *Iron Age*, **153** [5] 48–53 (1944).—European practice using carbon lining, either monolithic or block, is highly recommended. The rammed carbon lining is less expensive than block, but it is inferior in mechanical strength and in heat conductivity. Even at 3700°F. carbon refractories have the same mechanical strength and load-bearing capacity as at ordinary temperatures. The coefficient of heat conductivity is 10 to 15 times that of firebrick. Except that they may not be exposed to oxidizing temperatures above 650°F., carbon refractories would form the ideal lining for all kilns and furnaces in which linings deteriorate rapidly under the action of high temperature, mechanical stresses, and chemical attack. 12 references. E.H.McC.

Conversion of certain refractory oxides to a suboxide form at high temperatures. C. A. ZAPFFE. *Jour. Amer. Ceram. Soc.*, **27** [10] 293–98 (1944).—32 references, 2 illustrations.

Determination of the temperature distribution in the Dinas partition wall of a coke oven. M. D. TAMARIN. *Koks i Khim.*, **1940,** No. 9, pp. 29–33; abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 174A (1942).—An approximate heat-flow method of calculation is used to determine temperatures both in the partition wall and in the coke charge at different distances from the heated side and various times after charging. The bearing of the rates of heating and cooling on the life of the Dinas refractory wall is considered.

Direct-arc electric furnace refractories. E. R. PRYOR. *Trans. Amer. Foundrymen's Assn.*, **51** [4] 878–96 (1944).—P. covers various causes of refractory failures and shows the application of refractory products to direct-arc electric furnace practices. Materials considered include silica refractories and mortars and basic and chrome, sillimanite, and superduty and high-alumina refractories. Methods of furnace-lining design and their relation to furnace operating conditions are discussed. Necessity of proper design of door arches, jambs, and roofs and the selection of proper refractories for these points are particularly stressed. The performance of masonry linings and monolithic linings of the sillimanite type is shown. M.A.S.

Disintegration of fire-clay products by mixtures of carbon monoxide and carbon dioxide. G. R. RIGBY, H. BOOTH, AND A. T. GREEN. Reprinted in *Trans. Brit. Ceram. Soc.*, **43** [4] 73–80 (1944); see *Ceram. Abs.*, **21** [10] 213 (1942). R.A.H

* **Efficiency of heat exchangers.** P. GRASSMANN. *Ann. Physik*, **42** [2/3] 203–10 (1942).—The principles and theory are developed and applied to practical cases. M.HA.

Equilibria of liquid iron and simple basic and acid slags in a rotating induction furnace. C. R. TAYLOR AND J. CHIPMAN. *Amer. Inst. Mining Met. Engrs. Tech. Pub.*, No. 1409; *Metals Tech.*, **9** (Sept., 1942); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 83A (1943).—The authors report the results of a laboratory study of the equilibrium conditions between liquid iron and slags of the system (CaO + MgO)–SiO_2–FeO prepared in a rotating induction furnace similar to that described by F. W. Scott and T. L. Joseph (*Metals & Alloys*, **15** [3] 415–19 (1942)). The solubility of iron oxide in liquid iron under pure iron oxide slags was redetermined and found to differ only slightly from previously reported results. The equilibrium oxygen content of the metal at 1600°C. was taken as a measure of the activity of iron oxide in the slag. The indications were that no compound is formed between silica and ferrous oxide at 1600°C. Dicalcium silicate exists as a double molecule, $2(CaO \cdot SiO_2)_2$, and is substantially undissociated at 1600°C. On the basic side of the orthosilicate, the excess lime combines with the iron oxide to form $CaO \cdot Fe_3O_4$ in amounts depending on the CaO available after the formation of the $2(CaO \cdot SiO_2)_2$. The effect of magnesia was found qualitatively to be almost the same as that of lime for amounts up to at least 10%. The solubility of nitrogen in pure iron was checked and found to be 0.040%.

Foundry applications of high-temperature heat insulation. G. W. PATTERSON. Presented at meeting of American Foundrymen's Assn., Buffalo, N. Y., 1944; abstracted in *Ind. Heating*, **11** [8] 1328–29 (1944). M.HA.

Heat insulation and its problems. W. GOLDSBROUGH AND S. G. THROSSELL. *Brit. Steelmaker*, **8**, 354–58 (Dec., 1942); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 74A (1943).—The authors show how to calculate heat balances for furnaces with particular reference to the advantages of using insulating brick.

High-frequency induction furnace: XI, Working of the basic coreless induction furnace. W. BOTTENBERG AND P. BARDENHEUER. *Mitt. Kaiser-Wilhelm Inst. Eisenforsch. Düsseldorf*, **24** [2] 7–22 (1942); abstracted in *Jour. Iron & Steel Inst.* [London], **146** [2] 54–55A (1942).—After indicating the limits of the applicability of acid coreless induction furnaces, the authors review the literature on basic linings for these furnaces and then report on their own investigation, in which they studied a number of ordinary and special qualities of magnesite, with and without additions and binders, with regard to their suitability as lining material for coreless induction furnaces, especially their resistance to abrupt changes in temperature and to attack by slags. After some preliminary experiments in crucibles, they used a 250-kg. coreless induction furnace for their investigation. They arrived at the following conclusions: (1) The liability to crack formation is different in various qualities of magnesite; some special brands are only slightly sensitive to changes in temperature, whereas the ordinary ones are so sensitive that their use for these furnaces is out of the question. (2) The admixture of glass powder causes good sintering and bonding of the magnesite mass, even at relatively low temperatures, so that the tendency to spalling becomes less and the resistance to mechanical stress greater. (3) The deleterious effects of the shrinkage of sintered magnesite can largely be suppressed by applying as low temperatures as possible for the first few melts. (4) Only some of the magnesites examined withstand the attack of strongly oxidizing slag as obtained on melting soft steels, whereas all qualities are sufficiently resistant to the medium-oxidizing slags that occur in the production of hard steels. (5) In the continuous process all mixtures are fairly resistant to deoxidizing slags, but in the intermittent process any basic lining is completely destroyed by them. The disintegration of the mass after cooling can be counteracted, however, by a special slag-melting process that does not affect the degree of deoxidation of the steel. The use of magnesite brick is briefly discussed, and suggestions regarding its arrangement in the furnace are made. For reasons connected with furnace design they are suitable for large furnaces only. The metallurgy of the basic-lined coreless induction furnace is outlined, and details are given of several carbon and alloy steel melts produced by the authors to demonstrate the suitability of this furnace for refining. In an appendix, brief reference is made to the experience gained in practice during the last three years when using 600-kg. and 1200-kg. basic coreless induction furnaces for the production of various types of alloy steel. **XII, Attempts to increase the safety and durability of the basic lining.** P. BARDENHEUER AND R. BLECKMANN. *Mitt. Kaiser-Wilhelm Inst. Eisenforsch. Düsseldorf*, **24** [2] 23–29 (1942).—The main reason why the coreless induction furnace with a basic lining has not become popular is the danger of perforation of the lining, which would result in the molten steel coming into contact with the cooling water and causing an explosion. The liability to perforation is due to the high thermal conductivity of basic refractories, which leads to general heating up and sintering of the relatively thin linings used. Various means are suggested for keeping the temperature of the outer zone of the lining low, so that any molten steel penetrating that far will solidify immediately and a complete penetration will not occur even with very high furnace temperatures. If the outer zone of the lining is kept cool, it becomes possible to select the furnace lining material mainly on the basis of its resistance to slag attack; formerly the spalling resistance was the primary consideration. In the authors' experiments, ordinary sintered magnesites proved to be equal to special grades and to electrically fused magnesia in resistance to slag attack. Compositions of slags which are less deleterious to the lining are suggested.

High-porosity sillimanite brick: I and II. F. H. CLEWS, N. E. DOBBINS, AND A. T. GREEN. *Bull. Brit. Refrac. Research Assn.*, No. 44, p. 31 (1937); No. 52, p. 42 (1939); reprinted in *Trans. Brit. Ceram. Soc.*, **43** [5] 81–89 (1944); see *Ceram. Abs.*, **20** [2] 46 (1941). R.A.H.

High temperature resistivity measurements on compressed granular refractory materials. G. H. FETTERLEY. *Trans. Electrochem. Soc.*, **83**, 191–204 (1943).—A quick, economical method has been developed for the determination of the specific resistance of compressed granular refractory materials at temperatures up to 1000°C. The accuracy is sufficient for commercial control purposes. A criterion of electrical quality, the resistivity coefficient, has been developed for predicting the performance of periclase as the insulating material in electric heating elements. The leakage resistance of tubular heating elements insulated with periclase has been found to be proportional to the resistivity coefficient of the grain used for insulation. The theoretical derivation and method of calculation of this factor are given. The Joffé law, $R_s = Ae^{(B/T)}$ or $\log R_s = A + (B/T)$, has been verified for periclase in the range 600° to 1000°C. R_s is the specific resistance, A and B are constants, T is the absolute temperature, and e is the exponential value 2.718. Results of measurements on periclase of different degrees of purity are in general agreement with those obtained by Rochow and by Heine. It is shown that some additions to periclase, notably alumina, increase its resistivity to a useful degree below 1000°C., though the effect is probably opposite at very high temperatures. The presence of iron and boron are shown to be especially harmful. Periclase and especially alumina were found to show dielectric absorption effects. In the case of periclase containing alumina or spinel, the ratio of d.-c. to a.-c. resistance was found to be a function of the alumina content. In the course of this work a number of incidental observations were made regarding the electrical properties of compressed granular insulating materials. Some of these are included for what they may be worth to other investigators in the same field. Illustrated. F.G.H.

Hot-face insulation. T. S. PEARSON. *Brit. Steelmaker*, **8**, 348–52 (Dec., 1942); abstracted in *Jour. Iron & Steel*

* From microfilm.

Inst. [London], **147** [1] 74A (1943).—P. discusses the advantages and limitations of brick for insulating the hot face of furnace walls to reduce the amount of heat absorbed by the furnace structure. Two types are available, and these are suitable for maximum hot-face temperatures of 1200° and 1350°C. Their heat-absorption capacity is about one-third that of firebrick. The advantage of using them is greater with intermittent furnaces than with continuous furnaces, but with the latter a greatly improved response to variations in fuel control is at once apparent.

Industrial survey of refractory service conditions in electric furnaces used in steel manufacture: I, Arc furnaces; II, Coreless induction furnace. Prepared by E. E. CALLINAN. *Proc. Amer. Soc. Testing Materials*, **43**, 230–40 (1943).—Electric arc furnaces for steel production may be divided into the two classes, basic and acid, depending on the type of refractory used in the hearth. The metallurgical functions for which the furnace is used may be (1) melting only, (2) melting and refining, or (3) refining only. The service life of refractories varies according to the above classification. Most direct-arc furnaces are designed for 3-phase, 60-cycle operation. The path of the electric current for each phase is through one electrode, across the arc, and through the slag and metal to another electrode, being completed through the external circuit of the power transformer. Capacities of such furnaces range from 0.5 to 100 tons. In general, they are circular in shape and use three electrodes, the maximum diameter being about 20 ft. Charging is done through the roof or the door. Nominal charges range from 5000 to 170,000 lb., and transformer capacities range from 1000 to 18,000 kva., except for elliptical arc furnaces which have six electrodes. Tapping is done by tilting the furnace. Electrodes are either of the graphite or the carbon type. In the basic process, the first slag additions are made after the scrap is partially melted and usually consist of burned lime with a small amount of fluorspar or sand as a flux. The heat can be finished by any one of three different slag practices. Such slags, after cooling, usually contain dicalcium silicate; a solid solution phase of magnesium, manganese, and ferrous oxide; and free lime. In general, electric-furnace slags are more fluid, and therefore more corrosive, than open-hearth slags. Bottom refractories consist of fire-clay brick next to the furnace shell and then magnesite brick, upon which is placed the basic grain bottom material, commonly dead-burned magnesite and dolomite suitably bonded. Side walls are of either silica or basic brick. They must be mechanically strong and tight. Silica, kyanite, or diaspore fire-clay brick are used to construct the dome-shaped roofs. Kyanite and alumina-diaspore refractories have been successfully used for door arches. Tapholes are usually of refractory clay tile. In the acid process, the melt is usually made under a siliceous slag with the typical composition FeO 15, MnO 21, SiO_2 58, CaO 4%, and impurities such as Al_2O_3, Cr_2O_3, etc. All refractories are of the acid type. Roofs and side walls are of silica brick. A suitably bonded silica grain material is used for the bottom. The coreless induction furnace can be acid or basic and is used for making fine steels and alloys. It is essentially an air-core transformer, the primary of which is the furnace coil and the secondary is the melt. Frequencies range from 900 to 2000 cycles in large furnaces and are higher in smaller ones. Close control is the keynote. Induction furnaces are cylindrical, of the nose-tilting type, and range from 2 to 16,000 lb. (usually 600 lb. and up). The melting cycle is 1 to 3 hr., and the furnace is top-charged. Furnaces up to 650-lb. capacity are usually lined with a prefired crucible. The coil is first covered with a 0.25- to 0.375-in. coating of refractory mortar of the kyanite or mullite type. The crucible is then set in a bed of granular refractory, which is tamped into the space between it and the coil. The lining is sintered during the first melt. In basic furnaces, preformed crucibles may be of clay-bonded magnesite and packed in the furnace with magnesite, zirconium silicate, or alumina grain of the correct grain size. For acid linings, a mixture of ganister and fine silica flour is used. The life of such refractories varies over the wide range of 30 to 300 heats. Illustrations and tables aid in this detailed article on electric steel furnace refractories. W.R.B.

Insulation of furnaces. G. E. FOXWELL. *Brit. Steelmaker*, **8**, 266–72 (Oct., 1942); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 2A (1943).—F. explains calculations respecting thermal conductivity and heat losses due to radiation and convection and discusses the benefits that can be obtained by insulating industrial furnaces. In general terms, insulation reduces the loss by conduction through the walls without sensibly increasing the mass of brickwork and the corresponding loss by heat storage. Furnaces should therefore be constructed with reasonably thick insulation and with the thinnest practicable firebrick lining consistent with adequate strength and durability.

Insulation in high-temperature furnace construction. C. S. DARLING. *Mech. World & Eng. Record*, **110**, 279–80, 283 (Oct. 24, 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 44A (1942).—Some advantages of using insulating brick on the outside of industrial furnaces are discussed, and calculations showing the decrease in the heat-loss rate after applying insulation are presented.

Insulation of steel-plant equipment. J. H. CHESTERS. *Iron Age*, **154** [8] 42–49; [9] 47–52, 90 (1944).—The justification of insulation depends on (1) the saving in fuel, usually hard to determine accurately; (2) the effect on the output of the furnace; (3) the increase or decrease in the cost of refractories, including insulation; and (4) the cost of alteration of plant to permit insulation. Insulation of reheating furnaces is usually justified if it does not involve extensive structural changes. Insulation of open-hearth furnaces presents a different problem with each furnace; it must be considered with respect to the entire furnace and perhaps modified by experience. Various insulating materials are discussed in relation to their properties and applications, insulating cements and coatings are reviewed, and thermal conductivity is explained. Lengthy bibliography. E.H.McC.

Manufacture of electric furnace pig iron. C. HART. *Steel*, **115** [6] 111–14, 140 (Aug. 7, 1944).—Electric furnaces in Europe used for smelting iron ore are cylindrical crucibles with gastight tips. Outer rings are lined with chamotte brick, further improved by Radex or magnesite brick where conditions require greater heat resistance. The lining is further protected by filling the furnace; the stock lies against the lining and protects it as well as affording less strain on the electrodes. One ton of pigs can be made with 700 lb. of inferior fuel, 2000 kw. of energy, and 2 man-hours of labor. M.A.S.

Production results with basic-lined cupola. C. HEIKEN. *Giesserei*, (Oct. 26, 1943); translated in *Foundry Trade Jour.*, **72** [1437] 185–90 (1944). A.B.

Review of basic open-hearth practice at an Australian plant. R. L. KNIGHT. *Jour. Iron & Steel Inst.* [London], **147** [1] 233–97P (1943).—K. gives a comprehensive description of the plant and practice at the steelworks of Australian Iron and Steel, Ltd., Port Kembla. The plant is situated within 15 miles by rail of several collieries owned by the company; the limestone is brought 74 miles by rail from Marulan; red hematite ores, low in phosphorus, are shipped from the Whyalla deposits to Port Kembla, which is about 1070 miles. The open-hearth department consists of seven fixed furnaces varying from 160 to 240 tons capacity and a 1200-ton hot-metal mixer, the latter receiving metal from 70-ton transfer ladles filled from 120-ton ladles hauled from the blast furnaces. The open-hearth furnaces are fired with either tar and coke-oven gas or producer gas and coke-oven gas. They all comply with accepted modern standards relating to water-cooling and are equipped with modified Blair ports and water-cooled straight-line gates and valves. The tar is fed at 40 lb. per sq. in. and at 200°F., with steam for atomization at 60 to 80 lb. per sq. in. and 325°F. The outstanding features of the furnace practice are the high hot metal/scrap ratio, the heavy ore charge (448 lb. per ton), and the low flux rate. The furnaces are therefore subject to

violent and protracted ore boils, resulting in a heavy carry-over of solid particles in the waste-gas stream; in spite of this, three of the furnaces have produced ingots at a rate exceeding 21 tons per hr. During ten years' working, improvements in design enabled the 230-ton and 240-ton fixed furnaces to be built, which can carry such burdens continuously for campaigns exceeding 36 weeks. Details of these improvements in hearth, slag-pocket, and checker-chamber design are given. Five of the seven furnaces are all basic except for the roof and downtake arches; 95% silica brick are used for the roofs, the life of which varies with the type of fuel; an average roof life is 370 heats on producer-gas-fired units. Comprehensive descriptions of stockyard operations; charging, melting, and tapping practice; ingot-mold design and preparation; slag control; and the production of phosphorized sheet bars, of rimming steel, and of alloy and forging steels are included. 2 references, 16 figures.

Rocking electric furnace; a silver anniversary: I, History of the rocking furnace up to the formation of the Detroit Electric Furnace Company. H. W. GILLETT. *Trans. Electrochem. Soc.*, **83**, 207–11 (1943).—The investigation leading to the rocking furnace was started in 1911 and continued for several years. A historical record is presented of the difficulties encountered and how these were mastered. **II, History of the rocking furnace—1918 to 1943.** A. E. RHOADS. *Ibid.*, pp. 211–32.—The development of the Detroit rocking electric furnace is chronologically recorded. Several improvements in design finally led to the present type, of which there are almost 800 in operation today throughout the world. They are used for both nonferrous and ferrous metals. Detailed data are presented for a wide diversity of charge and metal specifications. The direct utilization of salvage raw materials at times introduces an economy approximating in value the entire cost of melting. Various types of refractory linings and their maintenance are discussed in detail. Illustrated. F.G.H.

Symposium on significance of tests on refractories: Significance of the pyrometric cone equivalent test of refractories and refractory raw materials. ROBERT B. SOSMAN. *Bull. Amer. Ceram. Soc.*, **23** [10] 367–70 (1944).—6 references, 4 diagrams. **Works control of uniformity of refractories.** E. R. HANNAH. *Ibid.*, pp. 370–72. **Significance of the panel spalling test.** L. C. HEWITT. *Ibid.*, pp. 372–73.—1 reference.

Temperature gradients through composite carbon columns and their application to blast-furnace linings. F. J. VOSBURGH AND M. R. HATFIELD. *Amer. Inst. Mining Met. Engrs. Tech. Pub.*, No. 1363; *Metals Tech.*, 8 6 pp. (Sept., 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 1A (1942).—The authors discuss the water-cooling of the shell plates of blast furnaces lined with carbon blocks and describe a laboratory investigation to determine the temperature which the shell plates of a carbon block lined blast furnace might reach when the furnace was operated at temperatures up to 3000°F. The apparatus used consisted of a heating element made of a horizontal carbon tube 30 in. long and 2.625 in. in outside diameter. The blast-furnace lining was represented by a composite column of carbon blocks 3.5 in. square and 29 in. high, with the lower end shaped to make a close fit on the carbon tube. A steel plate 3.5 x 3.5 x 1 in. rested on top of the column and represented the furnace shell plate. The whole of the test column was surrounded by 9 in. of charcoal particles in a box, but the upper surface of the top plate was left exposed. Holes with optical pyrometers were arranged for taking temperatures at the lower and hotter portion of the column, and thermocouples were used to take temperatures of the steel plate and the cooler portion of the column. Temperature-gradient curves for different grades of carbon blocks are presented; it was found that the thermal conductivity at room temperature of a suitable grade was 2 B.t.u. per sq. ft. per °F. per hr. per ft. With a furnace lined with carbon up to the mantel, working at as high a temperature as 3000°F., it is necessary normally to cool the shell with water, but it might be advisable to have facilities for emergency cooling with water or with an air blast.

Volume change attending low-to-high inversion of cristobalite. M. D. BEALS AND SAMUEL ZERFOSS. *Jour. Amer. Ceram. Soc.*, **27** [10] 285–92 (1944).—17 references, 6 illustrations.

PATENTS

Conditioned refractory material. G. E. SEIL (E. J. Lavino & Co.). U. S. 2,358,107, Sept. 12, 1944 (Feb. 28, 1942).—The process of forming refractory clinker that uses dolomitic starting material which comprises effecting a ground mix of dolomite and a silica-yielding material in proportions such that lime and silica of the mix lie in a range of ratios on a molecular basis between 1.5:1 and 2:1, heating the mix to yield periclase and a quantity of stabilized calcium silicate, and then by heat-treatment reducing in the mix the proportion of lime and of silica to magnesia with a concurrent increase in the content of MgO.

Fuel blocks or brick. A. F. BERRY. Brit. 562,798, July 26, 1944 (Jan. 21, 1943).

Furnace arch or roof construction. M. H. DETRICK CO. Brit. 563,593, Sept. 6, 1944 (Sept. 16, 1942).

Furnace or boiler arch. CLAUDE CALLAWAY. U. S. 2,359,619, Oct. 3, 1944 (March 25, 1942).

Making bottoms of high temperature basic furnaces. I. A. NICHOLAS. U. S. 2,358,652, Sept. 19, 1944 (June 25, 1941).—The method of making bottoms of basic furnaces which comprises spreading a relatively thick layer of a dry mixed batch of ground magnesite and ground chrome ore on the furnace hearth in the proportion of 60 to 90 parts magnesite and 10 to 40 parts chrome ore, adding a surface layer of dead-burned crushed dolomite or magnesite, and subjecting the upper surface of the material to a fusing temperature in excess of 2600°F. to form a sintered crust for receiving the furnace charge.

Making molds from graphite, etc. AKTIEBOLAGET HAMMARBYLAMPEN. Brit. 562,846, Aug. 2, 1944 (Feb. 15, 1941).

Manufacture of cup-like molds, etc., from graphite and other materials having compression characteristics similar to those of graphite. AKTIEBOLAGET HAMMARBYLAMPEN. Brit. 562,874, Aug. 2, 1944 (Feb. 15, 1941); divided out of Brit. 562,846 (see preceding patent).

Manufacture of powdered alumina. GENERAL ELECTRIC CO., LTD., R. C. CHIRNSIDE, AND L. A. DAUNCEY. Brit. 563,636, Sept. 6, 1944 (Feb. 15, 1943).

Melting refractory minerals in revolving-tube furnaces. GEORG ZOTOS (vested in the Alien Property Custodian). U. S. 2,358,903, Sept. 26, 1944 (Dec. 1, 1936).

Refractory heat-insulating material. CARBORUNDUM CO. Brit. 562,788, July 26, 1944 (Nov. 14, 1941).

Terra Cotta

Clay-stove research. DEWITT H. WYATT. *Stove Builder*, **9** [9] 24–28, 38–46 (1944).—8 illustrations.

Heat-shock resistance of chemical stoneware equipment. JOSEF M. ROBITSCHEK. *Ceram. Age*, **43** [1] 8–11, 26–27 (1944).—The heat-shock resistance of chemical stoneware equipment depends not only on the physical properties of the body used in its manufacture but also to a considerable degree on the shape and size of the object. Spherical vessels of regular shape and minimum thickness of walls will withstand for a considerable time heating and cooling which would immediately destroy tanks of rectangular cross section or objects of irregular shape. In this investigation four series of bodies, *A*, *B*, *C*, and *D*, were tested. Test specimens 6 in. long and $^1/_{125}$ in. in diameter were exposed to sudden changes of temperature within those limits to which chemical stoneware is normally subjected. These changes were more sudden than those to which stoneware equipment is generally exposed in actual

application. Modulus of rupture determinations were then made on the test specimens. The fact that some of the bodies tested withstand this thermal shock without any damage does not imply that medium-size or large objects made from the same bodies may be exposed to similar treatment. The work seems to prove, however, that the test method used offers a means of measuring the comparative resistance of bodies not only of one type but also of very different chemical and mineralogical composition and, further, that it offers some insight into the behavior of these bodies under thermal stresses of varying magnitude. The data from which this conclusion is drawn are as follows: (1) The sensitivity to thermal shock of bodies of identical chemical and mineralogical composition will decrease with increasing porosity of the bodies. Tests conducted on bodies of the *A* series prove that the method is sensitive enough to yield distinctly different results for bodies of slightly different porosity. (2) An increase of the flux content, which results in an increase of the quantity of amorphous glassy matrix in the body, will cause an increase in the sensitivity to thermal shock. Tests conducted on bodies of series *B* prove that the loss of strength caused by quenching from different temperatures increases with increasing flux content. (3) Equipment made of ordinary stoneware bodies will not withstand sudden heating to temperatures above 212°F. or sudden cooling from such temperatures; its durability usually is greatly reduced if it is exposed even to very careful but repeated heating to such temperatures. However, equipment made of heat shock resisting bodies of that type represented by the specimens of series *C*, characterized chiefly by a high content of mullite crystals, has proved in actual service that it may be used for heating up to temperatures of approximately 450°F. The results obtained by testing the bodies of series *C* are in accordance with this practical experience. (4) It may be assumed that a reduction of the thermal expansion coefficient and an increase of the heat conductivity of the glassy matrix of heat shock resisting bodies will further decrease their sensitivity to thermal change. The results of tests on bodies of series *D* confirm this assumption. Illustrated. See *Ceram. Abs.*, **23** [2] 40 (1944). F.G.H.

Space-heater program. GEORGE A. BOLE. *Ceram. Age*, **42** [6] 222–23 (1943).—B. presents a brief progress report on the development of a ceramic stove. F.G.H.

Whiteware

Comments on steatite. A. GUNZENHAUSER. *Ceram. Age*, **42** [3] 96 (1943).—G. discusses briefly a few of the applications of steatite bodies in the electronic and electrical-engineering fields. F.G.H.

Cup making. R. B. BLOORE. *Trans. Brit. Ceram. Soc.*, **43** [4] 63–68 (1944).—B. describes the successful production of finished cups, ready for the oven, within an hour. The filled cup mold is placed in a current of hot air with the mouth of the mold placed toward the hot air. The clay cup delivers from the mold in 5 or 6 min. The cup stove, which has a capacity of 99 molds, is described. R.A.H.

Dies made of steatite are cheap and quickly made. NICHOLAS H. SNYDER. *Ceram. Ind.*, **43** [2] 59–62 (1944).—Dies for the extrusion of ceramic ware can be made of steatite. The dies are accurately machined before firing and ground to final dimensions after firing. It is claimed that the wear of steatite dies is comparable to that of hardened tool steel, but their manufacture is simple and economical. Dies for pressing were tried only under low pressure, using magnesia as the medium to be pressed. H.T.

"Get ready for change," say whiteware men. ANON. *Ceram. Ind.*, **43** [1] 60–62 (1944).—Ideas and suggestions for research are given on the problem of improving ceramic processes to compete with other modern manufacturing methods. H.T.

High titania dielectrics. EUGENE WAINER. Abstracted in *Trans. Electrochem. Soc.*, **83,** 189 (1943).—The electrical properties and applications of titania ceramics are described. An attempt is made to explain on a rational basis the reason for obtention of the electrical properties involved and particularly the effect of various additions. Correlations between this explanation and experiments are given. (Publication of this paper has been prohibited by the U. S. Government until after the war). F.G.H.

Insulators washed on energized 132-kv. line. M. V. EARDLEY. *Elec. World*, **121** [16] 78–80 (1944).—In Los Angeles, dust deposited on insulators during dry weather becomes a conductor when moistened by September fogs. Before this can occur, dust is removed by a stream of water from a hose. The hose nozzle and the truck carrying the water tank are grounded, and a water pressure of 750 lb. per sq. in. is safely used at a distance of 15 ft. from the insulator. E.H.McC.

Low loss ceramics. R. RUSSELL, JR., AND L. J. BERBERICH. *Electronics*, **17** [5] 136–42, 338 (1944); condensed in *Ceram. Ind.*, **43** [3] 78–84, 96 (1944).—Zircon porcelains are widely used in insulation where heat-shock properties are important, e.g., in spark-plug bodies. Recently they have also been developed for high-frequency use. They are distinguished by high mechanical strength and low dielectric losses but comparatively high dielectric constant. Mechanical and physical properties of six ceramics used for high-frequency purposes are described, and test methods are given. The properties are given in the following table.

MECHANICAL AND PHYSICAL PROPERTIES OF SIX CERAMICS

	Zircon porcelain (Z-1)	Zircon porcelain (Z-2)	Steatite (S-1)	Ultrasteatite (S-2)	High-tension porcelain (P-1)	Clear fused quartz (F-1)
Specific gravity	3.68	3.76	2.6	2.7	2.4	2.2
Water absorption (%)	0.00	0.00	0.0–0.6	0.0–0.2	0.00	0.00
Dye penetration	None	None	In some cases	In some cases	None	None
Resistance to heat (constant use) (°C.)	1000	1100	1000	1000	1000	1000
Linear coeff. of thermal expansion (20° to 700° C.) per deg. C.	4.9×10^{-6}	3.68×10^{-6}	9.1×10^{-6}	8.8×10^{-6}	5.3×10^{-6}	0.5×10^{-6}
Heat shock	Passed	Passed	Failed	Failed		
Tensile strength (lb. per sq. in.)	12,700		8,000	7,500	5,000	
Compressive strength (lb. per sq. in.)	90,000		76,000	70,000	48,000	
Transverse strength (lb. per sq. in.)	25,000		20,000	17,000	11,000	
Impact resistance, modified Charpy method (gm. per sq. cm.)	17,800		17,400		6,000	

8 references. H.T.

More about ceramic mine production. ANON. *Bull. Amer. Ceram. Soc.*, **23** [10] 397 (1944); see *ibid.*, [9] 331.

OCIA reviews leadless glaze research. ANON. *Ceram. Ind.*, **43** [1] 64–66 (1944).—A report of the meeting of the Ohio Ceramic Industries Assn., at Granville, Ohio, June, 1944. H.T.

Preparing bodies for casting, jiggering, and pressing. ANON. *Ceram. Ind.*, **43** [1] 68–74 (1944).—Blunging, filter-pressing, dry-body preparation, and the making of casting slips as generally practiced in the pottery industry are discussed. 9 illustrations. H.T.

Slip-blending apparatus. C. T. WEDGWOOD. *Trans. Brit. Ceram. Soc.*, **43** [3] 51–58 (1944).—In England it is the common practice to mix the various ingredients of the pottery body in a given proportion in liquid form.

For calculating the specific gravity of the ingredients individually it is assumed that not more than 0.2% of the batch is used, whereas in the method described by W. the proportion is about 75%, which increases the accuracy of the measurements. The layout of the blending plant is given, and a graph (weight in lb. and volume in gal.) is included to explain the theory on which the method of blending is based. The formula is as follows: The total volume required in gallons $= \frac{V' \times X(S-1)}{(W'-10V')S}$, where V' = the initial volume run (gal.), X = the dry weight required (lb.), W' = the weight of the initial charge run (lb.), and S = specific gravity of the dry material. R.A.H.

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Aviation spark plug (radio shielded). JULIUS DEVINE. U. S. 2,358,911, Sept. 26, 1944 (Oct. 5, 1942).

Machines for making pottery ware. J. MADDOCK & SONS, LTD., R. A. MADDOCK, AND J. A. JOHNSON. Brit. 563,734, Sept. 6, 1944 (April 2, 1943).

Manufacture of electric insulators. STANDARD TELEPHONES & CABLES, LTD., AND J. K. WEBB. Brit. 563,032, Aug. 10, 1944 (Jan. 22, 1943).

Spark plug. W. W. HIGGINS (A. O. Smith Corp.). U. S. 2,359,421, Oct. 3, 1944 (Oct. 10, 1940).

Equipment and Apparatus

Atomic hydrogen arc welding. W. J. VAN DEN AKKER. *Steel*, **115** [3] 114–16, 166 (July 17, 1944). M.A.S.

Cemented carbide tools for machining ceramics. ANON. *Ceram. Ind.*, **43** [1] 40 (1944); *Sci. Amer.*, **170**, 228 (1944). The extreme hardness of cemented carbides makes them a suitable material for turning and drilling unfired insulators and for dies to press highly abrasive materials. H.T. & W.D.F.

Design and operation of rod mills. L. MOSES. *Iron & Steel Engr.*, **18**, 30–35 (Aug., 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 17A (1942).—M. describes the changes and improvements in layout in the rod mills at the works of the Bethlehem Steel Co., with particular reference to the arrangement of mill stands and the pass sequence.

Diffraction of X-rays by quartz in ultrasonic oscillations. J. SURUGUE AND TE-TCHAO OUANG. *Compt. Rend.*, **217** [6] 177–79 (1943).—The diffraction of X rays by the quartz shows a distinct increase of intensity in the Laue diagram if the quartz is set in vibration. An arrangement for imparting vibrations to the quartz is described; up to 595 kc. were used, and increases of intensities up to 150% were observed, depending on the voltage applied. M.HA.

Efficiencies, for particle determination, of the Electrotor Meter, the ultramicroscope, and the settlement counter. S. C. BLACKTIN. *Jour. Soc. Chem. Ind.* [London], **61** [10] 161–62 (1942).—Smoke from burning magnesium or match heads, containing 13,000 to 220,000 particles per ml. varying in diameter from 0.4 to 4 μ, was measured by the three instruments. The Electrotor Meter is the more adaptable, but all three are equally efficient. L.R.B.

Electron microscope, the supermicroscope, and metallurgical research. W. HENNEBERG. *Stahl & Eisen*, **61**, 769–76 (Aug. 14, 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 70A (1942).—H. explains the principles and methods of working of the electron microscope and describes some existing emission and electrostatic focusing electron microscopes and their application for the study of smokes, rust, and oxide films on iron and aluminum.

Electronic control for resistance furnaces. H. J. HAGUE. *Steel*, **115** [7] 106–108, 162–70 (Aug. 14, 1944).—The latest method developed for accurately controlling the temperatures of heat-treating and other furnaces involves a simple regulator system. M.A.S.

Electronics—its steel plant uses. J. H. HOPPER. *Steel*, **115** [2] 106–108, 127 (July 10, 1944).—Many mill problems are solved by the use of electronic devices. Electronic applications in industry include photoelectric limit switches, photoelectric pyrometers, photoelectric inspection, motor-speed control, resistance welding, power rectifiers, frequency changer, side register control, automatic screwdowns, timers, battery chargers, X-ray thickness gauge, flow brightening, electrostatic filters, and X-ray inspection of castings. M.A.S.

Experiments on the drying of clay. H. H. MACEY AND F. G. WILDE. *Bull. Brit. Refrac. Research Assn.*, No. 55, p. 111 (1940); reprinted in *Trans. Brit. Ceram. Soc.*, **43** [6] 93–104 (1944).—The drying of brick and of rectangular blocks on the hot floor and the way in which the rate of drying varies with time and moisture content were investigated. The rate of drying depends on the temperature of the floor and the humidity of the air. Formulas are given by means of which the rate of drying may be calculated from a knowledge of these factors. Experiments were carried out to determine the maximum safe rate of drying of wire-cut brick (*a*) in a chamber drier with a preheating period of 5 hr., (*b*) in a chamber drier without preheating, (*c*) on a hot floor with forced-air circulation, and (*d*) on a hot floor without forced-air circulation. The time required to attain the same average moisture contents by the different methods of drying was calculated. R.A.H.

Function of air during drying. CARL SCHMIDT. *Tonind.-Ztg.*, **66**, 439–41 (1942); abstracted in *Chem. Zentr.*, **1943, I** [7] 770.—Drying clay with a heat consumption of less than 840 Cal. per kg. evaporated water is impracticable. It is more or less feasible in tunnel driers. In the case of chamber driers, results are less satisfactory because more fuel must be used. By a careful consideration of all factors an efficiency of 65% for chamber driers can be counted a good value; this corresponds to a heat consumption of 1300 Cal. per kg. M.V.C.

How to operate a thickener. ROBERT H. RAMSEY. *Eng. Mining Jour.*, **145** [8] 84–87 (1944).—This is a good review. W.D.F.

Industrial fluoroscopic inspection. R. TAYLOR. *Steel*, **115** [4] 80–81, 124–26 (July 24, 1944). M.A.S.

Infrared heating for drying. ANON. *Sheet Metal Inds.*, **19**, 1215–16 (July, 1944).—A brief outline of conveyerized driers using electric and gas heating for drying paint finishes is given. A.B.

Infrared heating by gas. ANON. *Sheet Metal Inds.*, **19**, 686 (April, 1944).—An installation for drying small components finished in oil- and petrol-resisting paints is described. A.B.

Measuring the cutting temperature of sintered carbide tools by temperature-indicating paint. L. SCHALLBROCH AND M. LANG. *Z. Ver. Deut. Ing.*, **87**, 15–19 (1943); abstracted in *Ind. Diamond Rev.*, **4** [42] 113 (1944).—Experiments were made on temperature distribution and cutting temperature at constant and varying speed. The method using thermoindicating paint is informative and does not require expensive apparatus. P.G.

Optical cut method for the determination of surface roughness. J. F. KAYSER. *Foundry Trade Jour.*, **70**, 137–38 (June 17, 1943); abstracted in *Jour. Iron & Steel Inst.* [London], **148** [2] 132A (1943).—K. describes an optical method of obtaining a profile curve of a metal surface, or, more briefly, an optical cut. The apparatus used, which is described and illustrated, is a Vickers projection microscope, with a suitable addition to the illuminating system and a subsidiary stage to hold the sample to be examined. The illuminating system is so arranged that it is possible to focus the image of a straightedge on the surface under examination. The straightedge is provided by a stainless-steel safety-razor blade.

Platinum electrodes for electric analysis. J. C. CHASTON

AND H. W. WEBB. *Jour. Soc. Chem. Ind.* [London], **61** [9] 145–48 (1942).—The design of platinum electrodes for routine electrolytic analysis is discussed. Except for the determination of lead and manganese, the anode may be drastically reduced in size. Hardened Pt increases the strength of the framework. Illustrated. L.R.B.

Precision apparatus for the rapid determination of indices of refraction and dispersion by immersion. CONRAD A. FAICK AND BERNARD FONOROFF. *Jour. Research Nat. Bur. Standards*, **32** [2] 67–75 (1944); RP 1575. Price 10¢. See *Ceram. Abs.*, **23** [7] 123 (1944).

Proposed new type of pyrometer for measuring gas temperatures. R. H. ROWSE. *Jour. Sci. Instruments*, **18** [12] 240–42 (1941); abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 94A (1942).—Further consideration is given to a new type of pyrometer proposed by Blackie (*Ceram. Abs.*, **20** [11] 268 (1941)). The results of a general mathematical analysis are given, together with tables giving an abbreviated list of sets of wire gauges which satisfy the problem of multithermocouples for measuring the true temperature of flowing gases with a single reading.

Resonant vibration testing. R. O. FEHR AND C. SCHABTACH. *Steel*, **109**, 64–65, 96, 102 (Nov. 10, 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 152A (1942).—The authors describe various magnetic methods of exciting mechanical vibrations for high-speed fatigue tests on parts of various sizes and shapes. The principles are explained, and variable-frequency apparatus for testing turbine rotors is described and illustrated.

Sensitive photoelectric cell for the far ultraviolet. J. MATTLER. *Compt. Rend.*, **217** [5] 143–45 (1943).—M. describes a photoelectric cell in which a thick layer of cuprous iodide is deposited on a copper support by distillation in vacuum at about 700°C. The photoelectric current is proportional to the incident light for evacuated cells and increases slightly with gas-filled cells (argon, hydrogen, air). The sensitivity has a very pronounced maximum at about 2300 a.u. M.HA.

Simple apparatus for determining the fusion temperature of coal ash. J. HILES AND J. K. THOMPSON. *Fuel*, **20**, 135–37 (Aug.-Sept., 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 78A (1942).—The authors describe a Silit-rod electric furnace for the determination of ash-fusion temperatures using 1-in. "cones" in a reducing or an oxidizing atmosphere. The apparatus is simpler than any previously suggested and can be used with thermocouple control. The same furnace can be used with adapting rings of insulating fire brick to accommodate the tube of 0.875-in. bore for making carbon, hydrogen, sulfur, and chlorine determinations by the method described by Belcher and Spooner in *Fuel*, **20**, 130–33 (Aug.-Sept., 1941) (*Ceram. Abs.*, **21** [6] 130 (1942)). Cf. "Construction . . ., *ibid.*, [4] 86.

*** Sintering and melting of coal ashes in the heating electron microscope and the importance of the slag viscosity for the firing of the melting chamber.** K. ENDELL, A. ZINZEN, AND M. VON ARDENNE. *Feuerungstechnik*, **31** [4/5] 73–84 (1943).—An electron microscope is described for which an arrangement was developed for the electrical heating of the substances to be examined in the apparatus. The device is calibrated by the heating current required for the melting point of definite substances. With this arrangement, three lignite and six bituminous coal ashes were examined with 2500 electronoptic magnification as to their melting behavior at high temperatures from the beginning of sintering to complete flowing at 1600°C. In general, the results previously found by Bunte and Baum were confirmed, but in addition the temperature of the liquid melt could be determined. Liquid coal slags which should flow readily in the melting chamber should have a viscosity below about 150 poises. The prediction of viscosity possible for blast-furnace slags at a given temperature simply from the $SiO_2 + Al_2O_3$ content holds good also for the investigated bituminous coal slags; an empirical formula is developed. The practical possibilities of this investigation for the selection and mixing of fuels are discussed. M.HA.

* From microfilm.

*** "Stress-free" cementing of glass windows.** H. KÖNIG AND F. BERENS V. RAUTENFELD. *Z. Tech. Physik*, **23** [11] 273–77 (1942).—Electrooptic and magnetooptic experiments require that glass windows in the apparatus be absolutely stress-free; otherwise a birefringence occurs in the glass which causes serious errors in the measurements. To obtain glass windows of the smallest optical anisotropy, the heavy flint glasses SF 11 and SF 6 (Schott) are cemented to Calite and pure silver frames with silver chloride; SF 6 with Calite frame proves particularly good. Best results are obtained with round glasses on plane-ground Calite surfaces. In this way, the anisotropy in the center of the windows can be reduced, with the most careful handling, to about 5×10^{-8} λ. M.HA.

Temperature measurement and control of furnaces. C. SIEBER. *Metallwirtschaft*, **20** [24] 603 (1941); translated in *Sheet Metal Inds.*, **19**, 811–19 (May); 996 (June); 1178–80 (July); 1356–58 (Aug., 1944).—S. covers fundamental relations of control, delay of indication, thermal feedback, and various methods of compensated and step control. A.B.

Temperature measurement and control with solid photoelectric cells. MARLIN E. FOGLE. *Trans. Electrochem. Soc.*, **83**, 77–86 (1943).—Photoelectric pyrometers using solid photocells are described and compared with optical and total-radiation pyrometers for measuring and controlling high temperatures encountered in the metallurgical and ceramic industries. Advantages, limitations, and commercial applications of photoelectric pyrometers are discussed. Illustrated. F.G.H.

X ray uncovers hidden defects. ANON. *Ceram. Ind.*, **43** [1] 39–40 (1944).—The interior of a ceramic product can be investigated for voids, laminations, and inclusions by X rays. The method is used commercially in inspecting ceramics. 7 illustrations. H.T.

SEPARATE PUBLICATIONS

Apparatus for Differential Thermal Analysis. LOUIS H. BERKELHAMER. *U. S. Bur. Mines Rept. Investigations*, No. 3762, 17 pp. Free.—B. gives the design and construction details of an apparatus for the study of minerals by methods of differential thermal analysis. This method is outstanding as a means of studying the constituents of various substances, particularly clays, soils, and miscellaneous hydrous materials. R.A.H.

British Standard Code for Temperature Measurement, No. 1041—1943. British Standards Institution, London. Abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 205A (1943).—This temperature-measurement code is issued for the convenience of engineers responsible for the control and testing of heat-using equipment. The first section is, in effect, a condensed version of the whole and is intended as an introduction to the problem of temperature measurement for engineers without special training in this branch of physical science. Part I, Sections B, C, and D, is intended to assist in the selection of the method of temperature measurement. Parts II to V set out in detail the construction and use of instruments for each of the fundamental thermometric systems. Part VI deals with the electrical instruments employed. Parts VII to XII are to a great extent incomplete and are only a sketch of the survey of thermometric problems encountered in industry. Part XIII, which deals with calibration, is largely based on the methods used at the National Physical Laboratory.

Comparison of Fine-Series, Square-Mesh-Wire Test Sieves of Different Countries. R. E. BREWER. *U. S. Bur. Mines Rept. Investigations*, No. 3766, 5 pp. Free.—A table is presented which compares the standard fine series sieve scales used in Great Britain, the U. S., Germany, and France. The comparison shows the relationship between units of measurement and should prove useful in analyzing and testing powdered materials. R.A.H.

Permissible Mine Equipment Approved During 1943. E. J. CLEIM. *U. S. Bur. Mines Information Circ.*, No.

7283, 5 pp. Free.—This circular is a supplement to *Information Circ.*, No. 7207. R.A.H.

Precision Jigging as a Substitute for Laboratory Sink-Float. G. DALE COE AND WILL H. COGHILL. *U. S. Bur. Mines Rept. Investigations*, No. 3769, 7 pp. Free.—A method of appraisal of materials for gravity concentration is described that replaces much of the tedious sink-float fractionation formerly employed. It consists of jigging the sized charge for 10 min. in a plunger jig with a removable basket. R.A.H.

PATENTS

Induction furnace. EDWARD BENNETT (A. O. Smith Corp.). U. S. 2,359,285, Oct. 3, 1944 (July 17, 1942).

Instruments for determining the roughness of surfaces. BROWN & SON (Huddersfield), LTD., AND J. E. C. STRINGER. Brit. 562,488, July 19, 1944 (Jan. 12, 1943).

Universal ceramic machine. H. V. SCHWEITZER. U. S. 2,358,258, Sept. 12, 1944 (June 7, 1940).

Kilns, Furnaces, Fuels, and Combustion

American standard letter symbols for heat and thermodynamics. SANFORD A. MOSS. *Chem. & Eng. News*, **21** [23] 2035–36 (1943).—American Standard Z10.4—1943 (*Ceram. Abs.*, **22** [11] 204 (1943)) is discussed. F.G.H.

Effect of sulfur on flue-gas analysis. P. M. ROSS. *Engineer*, **178** [4618] 27–28 (1944).—Flue gas is usually analyzed with an Orsat apparatus. This measures the volumes of CO_2, CO, and O_2 in a sample, and the remainder is taken as N_2. Any SO_2 present is included with the CO_2. R. presents a formula for calculating the relative volumes of CO_2 and SO_2 if the ultimate analysis of the fuel is known:

$$W = \frac{11CO_2 + 8O_2 + 7(N_2 + CO)}{3(CO_2 + CO)} \times \left(c + \frac{3}{8}s\right) + \frac{5}{8}s,$$

where W = weight of dry flue gases per lb. of fuel, c = weight of carbon burned per lb. of fuel, and s = weight of combustible sulfur per lb. of fuel. G.A.K.

Efficient working of gas-producer plant. ANON. *Fuel Econ. Rev.*, **20**, 27–38 (1941); abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 6A (1942).—The efficient operation of gas producers is recognized as an important item in industrial practice, and practical guidance on the operation and management of gas-producer installations is given. Information is presented on (*a*) the fundamental basis and the mechanism of efficient gasification, (*b*) the function of steam in the blast, (*c*) the detection of inefficient operation, (*d*) fuel selection, (*e*) feeding, poking, clinkering, and ash removal, (*f*) controlling the blast saturation temperature and the gas pressure, (*g*) measuring the exit temperature, (*h*) metering the coal, air, gas, and steam, and (*i*) checking the quality of the gas.

Empirical heat capacity equations of gases. HUGH M. SPENCER AND GORDON N. FLANNAGAN. *Jour. Amer. Chem. Soc.*, **64** [10] 2511–13 (1942).—The authors present a table giving the equations and the percentage deviations of such equations representing the heat capacities of 61 gases in the following forms: (1) $C_p^0 = a + bT + cT^2$, (2) $C_p^0 = a + bT + c'T^2$, and (3) $C_p^0 = a + bT + cT^2 + dT^3$. Most of the equations of forms 1 and 2 were obtained as least square solutions of all the data in appropriate forms of heat capacity or mean heat capacity. Depending on the relative contributions of the various wave numbers over the range of temperatures concerned, one or the other of forms 1 and 2 is to be preferred. If the change of curvature with respect to the horizontal (T) axis is greater at the higher temperatures of a given range, form 1 is preferable, and vice versa. In some instances the range of temperatures is relatively so great that comparatively large deviations from the most appropriate 3-constant equation occur. Adjusted simultaneous solutions of form 3 are offered for these. It should be noted that empirical equations are unreliable for extrapolation. F.G.H.

Induction heating. ANON. *Sheet Metal Inds.*, **19**, 1389–96 (Aug., 1944).—The fundamental principles of induction heating and its application to metallurgical processes are discussed. A.B.

Producer gas. L. CLEGG. *Jour. Junior Inst. Engrs.* [London], **53**, 55–76 (Dec., 1942); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 119A (1943).—C. gives a comprehensive account of producer-gas practice, discussing (*a*) the effect of oxygen or air on hot carbon, (*b*) the effect of steam on hot carbon, and (*c*) the formation of combustible components of producer gas other than those formed by means of air or steam. He describes different types of gas producers and auxiliary equipment.

Producer gas at Homer Laughlin and its effect on ware. ANON. *Ceram. Ind.*, **42** [5] 42–45 (1944).—Producer gas at the Homer Laughlin China Co. plant is purified and therefore has no harmful effects on bisque firing. It is not suitable for firing periodic kilns. In tunnel kilns it seems to be as satisfactory both for bisque and glazed ware as natural gas. 5 illustrations. H.T.

Recent basic changes in technology of kiln and furnace design. ANON. *Steel Processing*, **30** [7] 448–50; [8] 511–16 (1944).—At the semiannual meeting of the American Society of Mechanical Engineers, June, 1944, a panel discussion covered changes in the field of industrial kilns and furnace design. Topics discussed were as follows: (1) surface heating by induction, (2) effect of controlled atmospheres on load-bearing properties of insulating firebrick, (3) engineering problems of high temperature forced convection heating, (4) four processes involving special atmospheres, (5) single production unit combining four process steps, (6) high frequency—the cold furnace, (7) patterned burner application, (8) consequences of trend to light-walled glassware, (9) factors affecting rates of heat transfer in practical production, (10) high-temperature salt baths, (11) billet-heating furnaces, (12) developments in separately prepared furnace atmospheres, (13) electric salt-bath furnaces, immersed electrode type, (14) new basis needed for rating furnace production, (15) rate of heat absorption of steel in normal furnace operation, (16) ingenious proportional mixer-type kiln, (17) carbonitriding, and (18) improvements in the high temperature heat-treatment of ferrous metals by high-frequency induction. M.R.

Step forward in stoker firing. ANON. *Claycraft*, **17** [11] 601–608 (1944).—A new method of stoker firing known as the Barratt-Halsall method is described. Advantages claimed for this stoker are as follows: (1) elimination of all black smoke except that caused by carelessness, (2) automatic stoking that results in a 50% saving in fuel costs, (3) a thermal efficiency of 8.1% compared with 4.3% in an oven of similar type and size fired the old way, (4) increased life of saggers, and (5) decrease in cost of repairs. Illustrated. G.A.K.

Sulfur recovery from gases. J. K. CHOWDHURY AND R. M. DATTA. *Jour. Indian Chem. Soc.*, (Aug., 1943); abstracted in *Chem. Trade Jour.*, **114** [2956] 54 (1944).—Al_2O_3 or MnO_2 increases the activity of Fe_2O_3 for H_2S absorption from coke-oven gas. Al_2O_3 improves the activity of carbon for the same purpose. L.R.B.

Thermal efficiency of industrial furnaces. H. SCHWIEDESSEN. *Stahl & Eisen*, **62**, 149–55 (Feb. 19, 1942); abstracted in *Jour. Iron & Steel Inst.* [London], **146** [2] 4A (1942).—S. discusses the theory of heat transfer and the factors that make up the total heat given up by a stream of hot gas passing through a furnace. The following ratios and data are involved: (1) the heat given up by the gas to the heat of combustion, (2) the useful heat to the heat given up by the gas, and (3) the product of ratios 1 and 2, which equals the useful heat divided by the heat of combustion. The determination of these three ratios enables the thermal efficiency of furnaces of different design to be compared. The value of ratio 1 can be improved

by (*a*) increasing the size and efficiency of the heat-absorbing surfaces, (*b*) making the furnace and flues airtight, and (*c*) maintaining the gas-air mixture so that combustion takes place without any excess of either gas or air. A high value for the ratio of the useful heat to the heat given up in the furnace can be obtained by (*a*) having the furnace walls well insulated and (*b*) increasing the ratio of the surface areas absorbing useful heat to the areas absorbing lost heat, i.e., places such as flues where the heat absorbed is not used. See "Comparison . . .," *Ceram. Abs.*, **22** [9] 159 (1943).

* **Treatment of stationary heat flow by means of electrical analogs.** F. MOELLER. *Elektrotech. u. Maschinenbau*, **61** [1/2] 4–8 (1943).—Heat flow in metals and heat-insulating materials can be calculated by substituting electrical circuits of suitable resistance. Examples are given. 17 references. M.HA.

Unreleased energy in flame gases. W. T. DAVID AND J. MANN. *Nature*, **154** [3899] 115 (1944).—Temperature measurements were made by means of fine quartz-coated platinum wires in mixtures of air with hydrogen and with carbon monoxide and hydrogen in various proportions. It was found that for any given mixture strength the hydrogen flame-gas temperature is more than 200°C. higher than the carbon monoxide (with 5% hydrogen) flame-gas temperature. G.A.K.

Use of controlled atmospheres in the metal industries. ANON. *Sheet Metal Inds.*, **19**, 243–50 (Feb., 1944).—In the treatment of ferrous metals, the accurate control of furnace atmospheres eliminates one variable. The different atmospheres encountered are discussed, mainly from the standpoint of heat-treatment. A.B.

Wet-cleaning of blast-furnace gas. F. THÖNNESSEN. *Stahl & Eisen*, **62**, 61–65 (Jan. 22, 1942); abstracted in *Jour. Iron & Steel Inst.* [London], **146** [2] 6A (1942).—T. reports on experiments undertaken to improve the efficiency of the gas washers for cleaning blast-furnace gas at the Julienhütte. The specified quantity of water for the Dingler washer can be reduced, and the desired dust removal and cooling of the gas can still be maintained. This means that the size and power requirements of the sludge plant can also be reduced. The beneficial effect of putting in a hot-water scrubber in front of the Dingler washer is discussed, and process data on water consumption and the reduction in the temperature and pressure of the gas at various stages of cleaning are presented.

What is entropy and what purpose does it serve? G. NEUMANN. *Stahl & Eisen*, **62**, 89–91 (Jan. 29, 1942); abstracted in *Jour. Iron & Steel Inst.* [London], **146** [2] 4A (1942).—Entropy is a mathematical expression that makes it possible to show in a single table the relation between the temperature, pressure, volume, and heat content of a body in the temperature range from absolute zero to the highest temperatures attainable. N. gives examples of the application of entropy.

* From microfilm.

SEPARATE PUBLICATIONS

British Standard Test Code for Kilns for Heavy Clay Ware, Including Refractory Materials, No. 1081—1942. British Standards Inst., London. Price 10s 6d, post free 11s. Abstracted in *Chem. Trade Jour.*, **112** [2904] 54 (1943).—The code covers intermittent, continuous car tunnel, ring tunnel, and chamber continuous kilns. L.R.B.

Fuel Oil and Its Combustion. Published by North American Manufacturing Co., Cleveland, Ohio, 1943. Partially reprinted in *Enamelist*, **21** [10] 25–29; [11] 30–39, 52–55 (1944). V.D.F.

Gas Chemists' Book of Standards for Light Oils and Light Oil Products. V. J. ALTIERI. American Gas Assn., Inc., New York, 1943. 352 pp. Reviewed in *Chem. & Eng. News*, **21** [19] 1655 (1943). F.G.H.

Geology

Adsorption of some organic dyes by clays and clay minerals. V. L. BOSAZZA. *Amer. Mineralogist*, **29**, 235–41 (1944).—Quantitative determination of the amount of malachite green, Congo red, and methyl violet adsorbed by three kaolins, a bentonite, and a montmorillonite showed variation with the different minerals, but the dyes gave the same value. Qualitative tests of these dyes on over 400 samples of clays showed adsorption by all, and the color was stable on drying. Using colorless amines on the same clays, such as *o*-toluidine, benzidine, diphenylamine, etc., B. found that only those clays gave a color which contained montmorillonite or illite, and this color disappeared on drying. W.D.F.

Alabama today—and tomorrow. ANON. *Mfrs. Record*, **113** [8] 65–103 (1944).—Alabama industries and natural resources are described. The mineral resources of Alabama constitute a source of great wealth. Thirty-one minerals occurring in quantities sufficient for commercial utilization are scattered throughout the state. There are clays suitable for high grade pottery use, and numerous deposits of silica are suitable for the manufacture of glass and glassware of the best grades. 80 photographs. M.R.

Beneficiation of Arkansas bauxite. S. M. RUNKE AND R. G. O'MEARA. *Amer. Inst. Mining Met. Engrs. Tech. Pub.*, No. 1698; *Mining Tech.*, **8** [3] 9 pp. (1944).—Bauxite impurities are silica in kaolinite and quartz; iron in hematite, limonite, and siderite; and titanium as ilmenite, rutile, and leucoxene. Samples tested came from Saline and Pulaski Counties. The best results are obtained by removing the iron and titanium by gravity and magnetic concentration, and then using flotation to remove the hydrous aluminum oxides. The pulp must be well dispersed for flotation. Products containing less than 8% silica were produced from all samples. The flowsheet for beneficiation would have to be very flexible to accommodate the rapid change in grade and character of the material. Flotation does not work on amorphous aluminum oxides intimately associated with kaolinite. W.D.F.

Birefringence of gypsum and of barite in the far red and near infrared. J. JAFFRAY. *Compt. Rend.*, **216** [12] 409–10 (1943).—Tables are given for both minerals between 6000 and 8800 a.u. The birefringence becomes weaker with increasing wave length. M.HA.

Brammallite (sodium-illite), a new mineral from Llandebie, South Wales. F. A. BANNISTER. *Mineralog. Mag.*, **26** [180] 304–307 (1943).—Alfred Brammall discovered a micaceous material associated with the illite shale overlying the coal measures at Llandebie, South Wales (see "Mica . . .," this issue), which proved on analysis to contain Na_2O 5.22 and K_2O 2.58%. X-ray and optic data included $a = 5.2$ a.u., $b = 9.0$ a.u., csin $\beta = 19.2$, $\alpha = 1.561$, $\gamma = 1.579$, $\gamma - \alpha = 0.018$, and $2V$ large. The X-ray powder data are given. Brammallite possesses the same a and b spacings as illite, but the basal spacing is lower. The properties of the five sericitelike minerals. paragonite, brammallite, illite, muscovite, and hydromuscovite, are listed. L.R.B.

British glass sands. ANON. *Chem. Trade Jour.*, **114** [2956] 56 (1944).—British sands from King's Lynn, Norfolk, England, and from Scotland now replace continental sands in English glassmaking. The owners of the former sandpits now also supply chemically purified sand. L.R.B.

Brucite being shipped to Maple Grove plant. ANON. *Pit & Quarry*, **37** [3] 67 (1944).—Basic Refractories, Inc., is shipping 6600 tons per month from its large brucite deposits in the Gabbs Valley section of the Mammoth district to its Maple Grove, Ohio, plant. The product is used extensively for furnace lining, high quality firebrick, and other purposes requiring resistance to high heat. M.R.

California's chromite assumes new importance. J. B. HUTTL. *Eng. Mining Jour.*, **143**, 43–46 (Oct., 1942);

abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 188A (1943).—H. gives a brief account of the occurrence of chromium ores in California, with some details of the concentration plants of the Rustless Mining Corp.

Chemical and mineralogical composition of twenty typical "limonites." ROLAND BLANCHARD. *Amer. Mineralogist*, **29**, 111–14 (1944).—B. gives the chemical analysis and mineralogical composition of twenty typical specimens of limonite selected from a much longer list. The quantitative mineralogical composition is also calculated. In limonitic jasper, the SiO_2 content may be as high as 73%. Other minerals which may be present are hydrated manganese dioxide, gypsum, jarosite, scorodite ($FeAsO_4 \cdot 2H_2O$), mimetite ($3Pb_3As_2O_8 \cdot PbCl_2$), massicot (PbO), organic iron salts, calcite, magnesite, siderite, rhodochrosite, and hematite. The iron is present mostly as either goethite or lepidocrocite, $Fe_2O_3 \cdot H_2O$. W.D.F.

Hand auger rapid, cheap to 140-ft. depth in clay. S. H. LORAIN AND MIRO MIHELICH. *Eng. Mining Jour.*, **145** [9] 78–80 (1944).—An ordinary posthole auger was used in drilling 360 holes with a total footage of 15,000 ft. of hole to sample high-alumina clay deposits in Idaho. An Iwan auger was used, which averaged 155 ft. before wearing out. The deepest hole drilled was 142 ft. This method is not economical over 130 ft. Total cost per foot was $1.411. W.D.F.

Helvite and danalite from New Mexico and the helvite group. JEWELL J. GLASS, RICHARD H. JAHNS, AND ROLLIN E. STEVENS. *Amer. Mineralogist*, **29**, 163–91 (1944).—Helvite and danalite occur on Iron Mountain, Sierra and Socorro Counties, in a contact zone between limestone and rhyolites and granite. The host rock is a dark-banded tactite made of magnetite, fluorite, chlorite, and diopside. Danalite is more prominent in a light-banded tactite; associated beryllium minerals are grossularite, idocrase, pink epidote, tilleyite, and thuringite. The helvite group consists of three isomorphous species: helvite, $Mn_4Be_3Si_3O_{12}S$, $G = 3.20$, $n = 1.728$; danalite, $Fe_4Be_3Si_3O_{12}S$, $G = 3.35$, $n = 1.771$; and genthelvite, $Zn_4Be_3Si_3O_{12}S$, $G = 3.70$, $n = 1.740$. Genthelvite occurs only in Colorado. Sixteen chemical analyses of members of this group were assembled, and the index of refraction was measured on all available material. A three-component diagram correlates chemical composition, specific gravities, and indices of refraction. These minerals resemble garnet; to separate them a staining test was devised: boil the mineral in dilute H_2SO_4 to which a little As_2O_3 has been added, wash with water, and examine while wet; the helvite turns a brilliant canary yellow. W.D.F.

How a new filter design raised vanadium output. ROBERT H. RAMSEY. *Eng. Mining Jour.*, **145** [7] 78–81 (1944).—This filter is a new design which may be of use in other processes. The ore is crushed to minus 10 mesh, roasted with sodium chloride, and quenched in water to dissolve the sodium vanadate; the solution is filtered off, which must be done rapidly. In the conventional filter a slime zone formed on top of the feed reservoir and coated the filter, slowing the filtration; agitation did not help. A new double drum was developed. The drums are in contact and revolve in opposite directions so that the filter cake passes over the top of each drum. The feed reservoir is on top and between the drums; the filter comes in contact first with the coarse sand and last with the slime. The filtration is so rapid that the cake can be washed with three sprays before it is discharged. Probable applications of this Syncro-Drum filter may be found in handling fertilizers, alumina, spodumene, feldspar, mica, cement rock, etc. W.D.F.

Hydrotungstite, a new mineral from Oruro, Bolivia. PAUL F. KERR AND FORD YOUNG. *Amer. Mineralogist*, **29**, 192–210 (1944).—A survey of the literature on hydrous tungstic oxide reveals that only one form has been established as a naturally occurring mineral (tungstite, H_2WO_4). A second hydrous oxide has been found in material from Calacalani, Department of Oruro, Bolivia. It has the composition $H_2WO_4 \cdot H_2O$ and has been called hydrotungstite to show its relationship to tungstite. It occurs in minute green tabular crystals as an alteration product of ferberite. Indices of refraction are $\alpha = 1.70$, $\beta = 1.95$, and $\gamma = 2.04$. Chemical, X-ray, and physical data are given. Artificial $H_2WO_4 \cdot H_2O$ has been prepared which corresponds to the natural mineral. Dehydration data indicate that the second molecule of water is held in a different manner from the first. As a result it is believed that the formula of tungstite may be best expressed as H_2WO_4 and that of hydrotungstite as $H_2WO_4 \cdot H_2O$. W.D.F.

Illinois State Geological Survey in war mineral research. M. M. LEIGHTON. *Illinois State Geol. Survey Circ.*, No. 104, pp. 133–52 (1944).—L. deals with the accomplishments of the fiscal year 1942–1943 and covers coal studies, oil and gas production, ground water supplies, fluorspar, zinc ores, dolomites, clay, limestone, and glass sand. Surface clays of the state are being studied to discover what heretofore overlooked commercial uses they may have, and success along certain lines seems likely. G.A.K.

Measurement of density by comparison with sands. A. CAILLEUX. *Compt. Rend.*; **217** [1] 30–31 (1943).—For the determination of the density of rocks and minerals, C. uses, instead of liquids, a sand containing 99% quartz and about 0.3 mm. in grain size. A beaker is two-thirds filled with well-dried sand, and a piece 3 to 7 mm. in length of the specimen to be determined is placed on the surface in the center. While the beaker is held in one hand, slight horizontal shocks are imparted to it with the other with the result that minerals or rocks of the same density as the quartz, i.e., 2.65, or lower, bury themselves a little but remain visible; they float on the sand bath; examples: amber 1.1, coal 1.3, gypsum 2.3, serpentine 2.55, and orthoclase 2.58. Minerals and rocks heavier than quartz sink and disappear, completely covered by the sand; examples: galena 7.4, magnetite 5.7, senarmontite 5.3, zirconium 4.7, stibnite 4.5, corundum 4.0, limonite 3.8, staurolite 3.7, disthene 3.6, topaz 3.55, augite 3.3, epidote 3.25, hornblende 3.2, bronzite 3.2, apatite 3.1, anhydrite 2.95, talc 2.75, and calcite 2.72. The error is about 1 to 2%. To give correct results the sand must be dry, the diameter of the vessel must be at least 5 times greater than the length of the specimen, and the grain size should be such that it is at least 8 to 10 times smaller than that of the fragments to be examined, but it should not be below 0.2 mm., as the mobility becomes insufficient. If the density of a specimen differs little from that of the sand, it is advisable to place on the surface, besides the specimen, two standards, one lighter and the other heavier. The former remains visible, the other disappears, and the behavior of the specimen can be seen immediately. In place of quartz, other substances can be used as standards. M.HA.

Mica of certain coal-measure shales in South Wales. G. NAGELSCHMIDT AND D. HICKS. *Mineralog. Mag.*, **26** [180] 297–303 (1943).—Fine fractions were prepared from six shales overlying anthracite and bituminous coal in South Wales collieries. X-ray diffraction and chemical analyses showed that these fine fractions contained illite with about 10% kaolin and 1% quartz. The X-ray pattern was very similar to that previously reported for illite. After correcting for the kaolin and quartz, the average chemical analysis gave $2.5(K,Na)_2O \cdot 1.3MO \cdot 9.9R_2O_3 \cdot 24SiO_2 \cdot 13H_2O$, computed on the basis of $24SiO_2$. The base-exchange capacity was average for illite, but the mean refractive index was 1.587. Dehydration data are given. It was noticed that the sodium content of the illite decreased slightly with decreasing rank of the associated coal, which has a bearing on McKenzie Taylor's theory of coal formation. L.R.B.

Mineral resources of Northern Rhodesia. T. DEANS. *Bull. Imperial Inst.*, **40** [4] 295–306 (1942); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 188A (1943).—D. gives an account of the development of the mineral resources of Northern Rhodesia. The total value of the minerals produced increased from £3,000,000 in 1924 to £66,000,000 in 1939. Copper ores easily take first place in production. The Nkana copper mine also produces important quantities of cobalt, the ore containing 0.02 to

0.5% cobalt in the form of the sulfide carrollite. Tungsten occurs, but not in economic quantities. There are some manganese deposits, but they appear to be of low grade and are not very extensive. Deposits of high-grade hematite and magnetite also occur; their extent is not known, and it is unlikely that an iron industry will ever be established.

Occurrence and uses of wollastonite from Willsboro, N. Y. JOHN G. BROUGHTON AND KOERT D. BURNHAM. *Amer. Inst. Mining Met. Engrs. Tech. Pub.*, No. 1737; *Mining Tech.*, **8** [4] 8 pp. (1944).—An anorthosite has invaded and partially replaced the pre-Cambrian Grenville formation, forming the wollastonite, which has been reported in a belt 0.25 mile wide and 6 miles long. It has been quarried irregularly on a small scale. The ore is friable, and even in the finest powders the lath shape of the mineral is preserved. It is separated magnetically from garnet and hedenbergite. The sole present market is in the preparation of coated welding rods. Other suggested uses are as a filler, in whiteware, pigments, etc. Estimated reserves at the one deposit worked are 100,000 tons. W.D.F.

Ohio's position in mineral industry. GEORGE W. WHITE. *Ohio State Univ. Eng. Expt. Sta. News*, **16** [2] 37–43 (1944).—Ohio stands ninth in total minerals production values. Ohio is in fifth place with coal, twelfth with natural gas, and eighteenth with petroleum. Ohio places second in the value of industrial minerals; it is first in clay and its products, second in limestone, first in lime, sixth in cement, third in salt, fourth in sand and gravel, and is a leading producer of gypsum and sandstone. W.D.F.

Potassium carbonate from wyomingite. C. E. MCCARTHY, STANLEY J. GREEN, AND A. GEORGE STERN. *Amer. Inst. Mining Met. Engrs. Tech. Pub.*, No. 1738; *Mining Tech.*, **8** [4] 9 pp. (1944).—One large deposit of wyomingite comprises one billion tons. It analyzes over 11% K_2O, and the potassium mineral is leucite, which is too fine to be liberated by grinding. Recently a large trona ($Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$) deposit has been found about 60 miles away. It is proposed to react the two and, by base exchange, obtain the potassium carbonate. The steps involved are (1) base exchange; (2) monohydrate evaporation, (*a*) first-stage evaporation, (*b*) desilicification, (*c*) second-stage evaporation, and (*d*) sulfate removal; (3) double salt; and (4) crystallization. There is an ample water supply, coal, natural gas, and transportation. The purity of the potassium carbonate would exceed 99.5%. W.D.F.

Report of Conference on Mineral Technology. RICHARD S. MCCAFFERY. *Jour. Eng. Education*, [N.S.] **31** [5] 432–38 (1941).—McC. reviews the topics covered by each of the six subcommittees on mineral technology at the meeting in Berkeley, Calif., during the summer of 1940. The six sessions were as follows: (1) fuels utilization, (2) geology, (3) petroleum engineering, (4) metallurgy, (5) mining, and (6) metallurgy, a round-table discussion on the teaching of nonferrous metallurgy. Session 4 on metallurgy was essentially a review of recent trends and practice in mineral concentration, including a discussion of screening, crushing, rod and ball mills, classifiers, flotation apparatus and reagents, drying, and gravity concentration. Also included in the report is a paper by Eugene A. Stephenson, "Scope and content of the petroleum engineering curriculum." E.W.R.

Sillimanite find in south proves important. W. C. HUDSON. *Eng. Mining Jour.*, **145** [9] 81 (1944).—Twenty bodies of sillimanite schist extend from near Talbottom, Ga., to near Spartanburg, S. C.; they carry economically recoverable sillimanite of high grade. One deposit is 200 ft. wide and 40 miles long and analyzes sillimanite 19; mica 50; quartz 25; garnet, ilmenite, and hematite 4; and others 2%. The sillimanite can be unlocked by grinding to pass a 42-mesh screen and can be beneficiated by gravity concentration and flotation. W.D.F.

Some aspects of the melting and crystallization of rock-forming minerals. J. F. SCHAIRER. *Amer. Mineralogist*, **29**, 75–91 (1944).—A general survey. W.D.F.

Spherulitic crystallization of anorthite. W. HUGILL. *Bull. Brit. Refrac. Research Assn.*, No. 53, p. 69 (1940); reprinted in *Trans. Brit. Ceram. Soc.*, **43** [5] 90–92 (1944).—The chief factors in the growth of spherulitic-type aggregates as distinct from normal anorthite crystals appear to be (1) an extensive area of liquid in proportion to its depth, with consequent limitation of convection currents; (2) the rate of cooling through the crystallization range, with consequent rapid change in viscosity of the liquid; and (3) the concentration of anorthite in the liquid, which does not appear to have much effect on the formation of spherulites. It does, however, govern their size. In some cases where the liquid was potentially rich in anorthite, the spherulites attained a diameter of 40 mm. R.A.H.

Structure of stilpnomelane re-examined. JOHN W. GRUNER. *Amer. Mineralogist*, **29**, 291–98 (1944).—New X-ray data show the distribution of ions normal to the basal cleavage in the layer silicate stilpnomelane. As it is similar to talc and biotite, a structure consistent with its properties can be proposed. It explains satisfactorily the behavior of the mineral, including its base exchange of K for Tl. Stilpnomelane is an important essential constituent of certain iron formations. W.D.F.

Tungsten find in North Carolina. W. H. MUNDS, H. B. EWOLDT, AND C. J. COHEN. *Eng. Mining Jour.*, **145** [8] 80–81 (1944).—A new tungsten area has been found in Vance County, N. C., which compares favorably with areas of the western U. S. Hubnerite and scheelite occur in quartz veins near a contact between a granite gneiss and a schist. Other associated minerals are rhodochrosite, fluorite, sericite, galena, sphalerite, pyrite, and chalcopyrite. The U. S. Bureau of Mines and a private company have explored the area. There are over 300,000 tons of ore averaging 0.96% WO_3. Several shafts have been sunk, and temporarily straight gravity concentration is being used. Over-all costs should not exceed $12 per unit of WO_3. W.D.F.

War focuses attention on Southeast's nonmetallics. O. C. RALSTON AND E. R. NICOLAI. *Mfrs. Record*, **113** [10] 52–53, 78, 80 (1944).—Some nonmetallic minerals and their use in total war are discussed. Mention is also made of the work of the U. S. Bureau of Mines in the South Atlantic states. Among the minerals discussed are clays, kaolin, graphite, bauxite, dolomite, kyanite, diatomite, barite, fluorite, and mica. 4 photographs. M.R.

White mica in Wissahickon complex. A. WILLIAMS POSTEL AND WILLIAM ADELHELM. *Amer. Mineralogist*, **29**, 279–90 (1944).—The white mica is found in a granite and the adjacent Wissahickon schist, in the Wissahickon valley, near Philadelphia, Pa. It was formed by hydrothermal metamorphism. The optic axial angle is very low, there being many grains with $2V$ less than 30°. A chemical analysis was made; recalculated, it gave the formula $(KNa)_{4.22}(MgFe'')_{1.14}(AlFe)_{10.41}(SiTi)_{12.89}O_{41.1}(OH)_{6.9}$. Indices of refraction were $\alpha = 1.573$, $\beta = 1.604$, and $\gamma = 1.611$. The low value of $2V$ first suggested that this was a phengite. A Laue X-ray photograph showed asterism; this is interpreted as a random shift of the layers. Low values for $2V$ in white mica may be caused by five factors acting singly or in combination: (1) high MgO content, (2) high Fe_2O_3 content, (3) moderate MgO and high Fe_2O_3 content, (4) random shift in the lattice structure, and (5) a hydrothermal replacement origin. W.D.F.

Zinc producer from gold prospect. JOHN B. HUTTL. *Eng. Mining Jour.*, **145** [7] 82–84 (1944).—The Bullfrog mine is in Grant County, N. Mex. It and several neighboring mines have started to produce zinc from fissure veins and faults in a 1000 ft. thick diorite sill. The principal ore mineral is sphalerite, with lesser lead and copper. Mining is done generally by shrinkage stoping, and the ore is loaded mechanically. The ore is crushed, ground, and put through flotation machines to produce a zinc concentrate and a lead concentrate. Ore production is 400 tons per day. W.D.F.

SEPARATE PUBLICATIONS

Applications of Thermal Analysis to Clays and Aluminous Minerals. SIDNEY SPEIL. *U. S. Bur. Mines Rept. Investigations*, No. 3764. 36 pp. Free.—The essential step in the process is the determination of the temperature at which any thermal reactions take place in the sample being studied and the magnitude of these thermal effects. The method is applied to various clays, bauxites, and aluminous minerals. R.A.H.

Geological and Geophysical Survey of Fluorspar Areas in Hardin County, Ill.: I, Geology of the Cave in Rock District. L. W. CURRIER with the collaboration of O. E. WAGNER, JR. **II, Exploratory Study of Faults in the Cave in Rock and Rosiclare Districts by the Earth-Resistivity Method.** M. K. HUBBERT. *U. S. Geol. Survey Bull.*, No. 942. 150 pp. Supt. of Documents, Govt. Printing Office, Washington, D. C. Price $1.25. R.A.H.

New Hampshire Mineral Resource Survey: III, Peat Deposits (Preliminary Report). GEORGE W. WHITE, with analyses by GORDON P. PERCIVAL. New Hampshire State Planning and Development Commission, Concord, 1941. 20 pp., 1 map, 12 references. Price, each part, 10¢. **IV, Sillimanite, Andalusite, Kyanite, and Mica Schist Deposits (Preliminary Report).** H. M. BANNERMAN. 1941. 7 pp., 6 references. **V, Fluorite Deposits of Cheshire County, N. H.** H. M. BANNERMAN. 1941. 11 pp., 4 illustrations, 2 references. **VI, Some New Hampshire Quartz Deposits (Preliminary Report).** T. R. MEYERS. 1941. 21 pp., 4 maps, 3 references. **VII, Structural and Economic Features of Some New Hampshire Pegmatites.** H. M. BANNERMAN. 1943. 22 pp., 8 illustrations, 19 references. **VIII, Sillimanite Deposits in the Monadnock Quadrangle, New Hampshire.** KATHARINE FOWLER-BILLINGS. 1944. 15 pp., 9 illustrations, 10 references. For Parts I and II see *Ceram. Abs.*, **21** [9] 200 (1942).

Strategic Minerals Investigations, 1942. ANON. *U. S. Geol. Survey Bull.*, No. 936. 18 pp. Supt. of Documents, Govt. Printing Office, Washington, D. C. Price 10¢. This pamphlet contains two sets of title pages, contents, list of illustrations, and indexes prepared to facilitate the binding of *Bull.* No. 936 in two parts. See "Chromite . . .," and "Tin- . . .," *Ceram. Abs.*, **22** [5] 87 (1943). R.A.H.

Structural Petrology. ELEANORA BLISS KNOPF AND EARL INGERSON. *Geol. Soc. Amer. Mem.*, No. 6, 270 pp., 27 plates, 81 figs. (1938).—The principles of structural petrology as developed mainly during the last quarter century and the laboratory technique of petrofabric analysis are discussed. Of particular interest are chapters on plastic deformation and the theories of plastic flow. The laboratory technique includes a study of thin and polished sections, use of the universal stage, and the preparation of petrofabric diagrams. A.C.B.

Universal Stage (With Five Axes of Rotation). R. C. EMMONS. *Geol. Soc. Amer. Mem.*, No. 8, 205 pp., 13 plates, 95 figs. (1943).—E. reviews briefly some fundamental concepts of crystal optics and then discusses in detail the use of the universal stage as the "petrographer's most powerful accessory," particularly for the precise study of the composition of minerals. A.C.B.

Chemistry and Physics

Behavior of fluorspar and of calcium phosphates in relation to the ferrous oxide in the melt and its metallurgical significance. W. OELSEN AND H. MAETZ. *Mitt. Kaiser-Wilhelm Inst. Eisenforsch. Düsseldorf*, **23** [12] 195–245 (1941); abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 179A (1942).—In steel production the action of fluorspar in lowering the viscosity of slags even at moderate temperatures and its effect on the lime are well known, but its influence on the other basic ingredients of slag, such as iron oxides, manganous oxide, silica, and phosphates, has not been the subject of much investigation. The authors therefore undertook a thorough investigation of the whole subject. Having established that, in the molten state, ferrous oxide and fluorspar are practically immiscible, and that the melting point of each is not appreciably lowered by the presence of the other, they determined the distribution, in slags having a lower layer rich in ferrous oxide and an upper layer rich in fluorspar, of lime, manganous oxide, silica, phosphorus pentoxide, iron sulfide, calcium orthosilicate, and calcium metasilicate. The slags were melted in iron crucibles at 1400° to 1450°C. The investigation of the FeO–CaO–P_2O_5 system led to the surprising conclusion that there is a lense-shaped immiscibility area of two layers which, with a P_2O_5 content under 40%, extends from the ferrous oxide corner across the isothermal ternary diagram toward the point of calcium orthophosphate concentration, and that this has two critical points, one near the FeO–P_2O_5 side at about 15% P_2O_5 and 1 to 2% CaO. Its position points to the fact that ferrous oxide/iron phosphate slags have a definite tendency to separate; this view is also supported by the form of the curve of primary crystallization of these slags between 0 and 25% P_2O_5. The addition of only a little lime causes the separation of these iron-phosphate slags into two layers. The tie lines are determined by the ratio (mole)CaO/(mole)$P_2O_5 < 3$; their direction indicates that the section FeO–$3CaO \cdot P_2O_5$ is a quasi-binary one. The solidification diagram for this section is developed, and it emphasizes the very low solubility of solid tricalcium phosphate in molten ferrous oxide as well as the breadth of the immiscibility gap in the molten state. The crystalline tetraphosphate, $4CaO \cdot P_2O_5$, is much less stable than the orthophosphate. As ferrous oxide and tricalcium phosphate, as well as ferrous oxide and fluorspar, in the molten state are thus seen to be only slightly miscible, while tricalcium phosphate and fluorspar are miscible, the system FeO–CaF_2–$3CaO \cdot P_2O_5$ will consist of two layers at almost all concentrations. Of these, the lower consists of almost pure ferrous oxide with small quantities of phosphorus pentoxide, calcium, and fluorine, and the upper one of tricalcium phosphate and fluorspar with only a little ferrous oxide. The ratio of the P_2O_5 contents of the upper and lower layers is about 128, and that of the iron in the lower and upper layers is about 42, at about 1400°C. in both cases. The separation of the two layers is also applicable to the system FeO–CaO–P_2O_5–CaF_2 when the (mole)CaO/(mole)P_2O_5 ratio is greater or less than 3. When this ratio is 3, special conditions obtain. When the ratio is less than 3, the upper layer still contains considerable amounts of ferrous oxide (of course mainly dissolved as iron phosphate), while with a ratio greater than 3, there is very little ferrous oxide in the upper layer. The distribution of the manganous oxide in the two layers for different CaO/P_2O_5 ratios was studied. As long as (mole)CaO/(mole)$P_2O_5 < 3$, most of the manganous oxide goes into the upper layer as manganese phosphate, but as the value of this ratio increases, more and more manganous and ferrous oxides pass into the lower layer. The changes in this distribution under different conditions are followed and explained. The relation between these laboratory investigations and the structure of basic Bessemer slags obtained in full-scale operations, as well as their significance in the magnetic methods of recovering iron and preparing manganese-rich concentrates, is discussed at length. A new technique is suggested for the separation of phosphorus from both iron and manganese; this comprises melting phosphoric ores, such as Kiruna ore, with or without additions of fluorspar or other fluxes containing fluorine or chlorine, and drawing off the upper phosphate-rich slag layer from the lower layer, which is rich in ferrous oxide and low in phosphorus pentoxide.

Behavior of iron oxide with some admixed foreign oxides at temperatures of about 1300°C. N. G. SCHMAHL. *Z. Elektrochem.*, **47**, 835–43 (Dec., 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **146** [2] 199A (1942).—S. studied the effect of the presence of BeO, Al_2O_3, Cr_2O_3, Mn_2O_3, SiO_2, and TiO_2 on the equilibrium $6Fe_2O_3 \rightleftarrows 4Fe_3O_4 + O_2$ by direct isothermal measurement of the

oxygen pressures prevailing in the systems. The temperature chosen for the experiments was as a rule 1323°C. but in some cases 1060°C. The results, which are represented as isothermal concentration-pressure diagrams, led to the following conclusions: (1) BeO, Al_2O_3, and SiO_2 affect the Fe_2O_3–Fe_3O_4 system relatively little. BeO does not form a spinel with Fe_2O_3 but adsorbs some Fe_2O_3. Al_2O_3 forms to some extent a solid solution with Fe_2O_3, but formation of the compound $FeO \cdot Al_2O_3$ could not be established. The presence of SiO_2 did not lead to silicate formation. (2) Cr_2O_3 and TiO_2 greatly affect the equilibrium by the formation of very stable solid solutions. The formation of ferric titanates was observed. (3) The presence of Mn_2O_3 leads to the formation of the spinel $MnO \cdot Fe_2O_3$.

Constitution of basic open-hearth slags. B. MASON. *Iron & Coal Trades Rev.*, **149** [3985] 39–43, 53 (1944).—A thorough investigation was made of structure, texture, and chemical characteristics by examination of thin and polished sections, determination of refractive indices, identification of the phases present by X-ray powder photographs, and separation and chemical analysis of the individual phases of the powdered slags. The individual phases found were as follows: (1) Olivine, $CaO \cdot RO \cdot SiO_2$ (R is used as a group symbol for Fe, Mn, Mg); it has been often identified in basic slags and is generally referred to as monticellite, which in the strict sense, however, is the mineral $CaO \cdot MgO \cdot SiO_2$, and olivine differs from monticellite in having a great part of the Mg replaced by Fe and Mn and therefore has quite different properties. The refractive indices are approximately $\alpha = 1.66$, $\beta = 1.68$, $\gamma = 1.69$, and the birefringence is about 0.03. (2) Merwinite, $3CaO \cdot MgO \cdot 2SiO_2$. The composition of this phase does not vary much from the ideal formula, the optical properties being $\alpha = 1.711$, $\gamma = 1.729$ (± 0.003). (3) Dicalcium silicate, $2CaO \cdot SiO_2$. This phase is said to occur in 3 forms, α, β, and γ. The α form is stable at temperatures from 1420°C. to its melting point at 2130°C.; the β form is stable between 675° and 1420°C.; and the γ form below 675°. In pure dicalcium silicate preparations, it is extremely difficult to obtain the α and β forms because of their very strong tendency to invert to the γ form on cooling. In slags, however, this inversion does not take place, probably because of the presence of foreign elements in solid solution. The refractive indices of this phase vary from slag to slag, α from 1.703 to 1.715 and γ from 1.713 to 1.729, very likely due to substitution of Si by P, which lowers the refractive index. (4) Tricalcium silicate, $3CaO \cdot SiO_2$; its refractive indices are $\omega = 1.722$, $\epsilon = 1.716$; the birefringence is considerably lower than that of the dicalcium silicate. (5) Dicalcium ferrite, $2CaO \cdot Fe_2O_3$; it crystallizes in the orthorhombic system and has high refractive indices. (6) A few other phases occur in very small amounts. Metallic Fe occurs in all slags, generally as small rounded pellets, besides a spinel of the magnetite type (RFe_2O_4) and a chromate phase (RCr_2O_4). A certain correlation between phase composition and chemical composition exists on which a classification of the slags into olivine slags, merwinite slags, and dicalcium and tricalcium slags can be based. M.HA.

Crystal structures of Fe, FeO, and Fe_3O_4 and their interrelations. H. J. GOLDSCHMIDT. *Jour. Iron & Steel Inst.* [London], **146** [2] 157–80P (1942).—A simple relation is shown to exist between the lattice dimensions of the three phases of the iron-oxygen system: α-iron (Fe), wüstite (FeO), and magnetite (Fe_3O_4). The close connection between the three structures, which are all cubic, explains why a comparatively easy transition from Fe to FeO, from Fe to Fe_3O_4, and from FeO to Fe_3O_4 is possible under practical oxidizing conditions implying limited access of oxygen. While the transition Fe → FeO is considered as a true oxidation, the change FeO → Fe_3O_4 is not, because the number of oxygen ions per crystal volume remains constant, only iron being lost. The wüstite range of solid solutions is discussed from the same aspect; the omission of ferrous Fe^{++} ions from lattice points under partial replacement by ferric Fe^{+++} ions is preparatory to the change-over to the Fe_3O_4 structure. The linear decrease of lattice spacing of wüstite with increasing oxygen content, as found by Jette and Foote (*Ceram. Abs.*, **12** [7] 281 (1933)), is utilized. It is observed that the lattice parameter of the Fe_3O_4 unit cell is in direct linear continuation of the same decrease. The ionic replacements within the lattice during this process are considered numerically in some detail; they finally lead to a distribution of ions agreeing with the known spinel structure. The structure of γ-iron is intimately connected with that of FeO, a fact which is corroborated by comparing the atomic volumes of all the phases concerned. It is suggested by this comparison that similar relations exist between α-Fe and Fe_3O_4 and between γ-Fe and FeO, each pair of phases being thus fundamentally associated, and that the γ-α change at 906°C. is coupled with the decomposition of FeO at 570°C.: [$4FeO \rightarrow Fe + Fe_3O_4$]. The results of some X-ray tests on layers of scales formed on pure iron are included mainly to illustrate (1) the decrease of the wüstite lattice constants with decreasing iron content and (2) the effect on the structure of the scale of exposing either α-Fe or γ-Fe to oxidizing conditions. The latter preliminary experiments revealed the innermost layer of scale to be pure wüstite if formed at, and quenched from, temperatures above A_3, and wüstite plus magnetite below A_3, the proportion of magnetite increasing with decreasing temperature. The facts discussed have a bearing on the problem of the corrosion resistance of steel. 21 references.

Decomposition of clay by heat. J. F. HYSLOP. *Trans. Brit. Ceram. Soc.*, **43** [3] 49–51 (1944).—The chief characteristics of heat-treated clay are described. Solubility tests of a heat-treated Scottish kaolinitic clay in hot soda solution show that the SiO_2 is chemically inactive. This, in conjunction with the X-ray determination of the crystalline phases, shows that 1 hr. at 700°C. gives inactive SiO_2, 15 hr. at 800°C. + 20 hr. at 1050°C. gives γ-Al_2O_3 + inactive SiO_2, and 15 hr. at 800°C. + 20 hr. at 1150°C. gives mullite + inactive SiO_2. R.A.H.

Dimensional analysis in electrochemical engineering. JAMES COULL AND J. ROGER SHIELDS. *Jour. Eng. Education*, [N.S.] **31** [7] 473–78 (1941).—The methods of dimensional analysis have found widespread use in the solution of problems involving heat flow, fluid flow, and stress analysis and complex problems of general mechanics, and no extensive mathematical knowledge is required for their application to highly complex situations. The basic principle of dimensional analysis is that all terms in an equation that describes a physical event must be capable of expression in the same system of fundamental dimensions. Thus, in the study of any problem, a system of ultimate units must be chosen such that the quantities involved can be expressed in terms of these units. A table of the dimensions of electrical quantities in terms of length, mass, and time in both the electromagnetic and electrostatic systems is given, followed by several examples of the use of dimensional analysis in the solution of electrical equations and its application to the designing of cells for electrochemical work. E.W.R.

Fast method for finding areas or mean ordinates of curves. A. D. MOORE. *Jour. Eng. Education*, [N.S.] **31** [7] 452–59 (1941).—M. describes a simple and rapid graphical method of obtaining the mean ordinate of any curve to any axis. The time involved is less than a minute for most curves, and the results are easily obtained, even by students, to within less than 1% error. Minimum error when done with skill and care is less than 0.5%, an accuracy greater than that to which most curves are plotted. From the mean ordinate the area under the curve may be obtained. The method is equally applicable for finding the area within a closed curve or within any area surrounded by curved lines. E.W.R.

Fluorescent chemicals. J. A. RIDLEY. *Jour. Soc. Dyers & Colourists*, (July, 1943); abstracted in *Chem. Trade Jour.*, **113** [2932] 113 (1943).—Suggestions for the use of fluorescent substances as tracing agents or differential stains or for advertising, etc., are given, with many examples of current usage. Anthracene, fluorescein, Rhodamine BS, and 4:4′-diamidinostilbene are suitable. The

fluorescent substances are brought into view with ultraviolet light. L.R.B.

Fracture and comminution of brittle solids. EUGENE F. PONCELET. *Amer. Inst. Mining Met. Engrs. Tech. Pub.*, No. 1684; *Mining Tech.*, **8** [3] 20 pp. (1944).—Glass squares compressed on edge by steel jaws in poor contact with them developed jagged "partial-contact" cracks caused by the formation of local tensile stresses. Compressed by steel jaws in perfect contact, they developed smooth "release cracks" on release of pressure. All these cracks were parallel to the pressure. A Microflash photograph of a disintegrating specimen under sufficient pressure reveals a network of fractures roughly normal to each other, together with "release cracks" and a disintegration cloud. The Griffith theory is amended to account for the formation of a first crack. A new theory, based on the theory of thermal agitation and wave propagation, is proposed to account for the progress, velocity, and forking of cracks. The network of fractures is shown to have been caused by reflection at a free boundary of pressure pulses emanating from a first crack. Postulating equal distribution of energy in the pulses emitted on either side by a crack in particles, the smaller fragments are shown to continue fracturing preferentially, while some of the coarser fragments remain as residual pieces. As comminution of the smaller fragments proceeds, the solid is reduced to a collection of residual particles of smaller and smaller sizes, accounting for the disintegration cloud. W.D.F.

Investigations of the ternary system CaO–P_2O_5–SiO_2 and its importance in the production of basic Bessemer slags. G. TRÖMEL. *Mitt. Kaiser-Wilhelm Inst. Eisenforsch. Düsseldorf; Stahl & Eisen*, **63**, 21–30 (Jan. 14, 1943); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 158A (1943).—T. discusses the results of an investigation of equilibria in the lime corner of the CaO–P_2O_5–SiO_2 system and by reference to these results explains the mechanism of the solidification of basic Bessemer slags, pointing out how the structures obtained influence the properties of the slag, especially the rate of solution in citric acid. The importance of the oxides of manganese and iron in commercial slags is related to the immiscibility phenomena in the CaO–P_2O_5–FeO system, and the reasons for the difficulties in producing good soluble slags in full-scale plant are discussed.

M.K.S. units in electrical engineering courses. PAUL L. MORTON. *Jour. Eng. Education*, [N.S.] **31** [9] 668–71 (1941).—The meter-kilogram-second (Giorgi) system of electrical units has received such widespread recognition in the last five years that general adoption by electrical engineers appears to be inevitable within the next decade. Many electrical engineering teachers, however, do not use this system. The reasons are (1) mental inertia, (2) commitment to texts using the old (c.g.s.) form, and (3) confusion as to just what constitutes the m.k.s. system. M. gives an appendix containing a number of equations in both the m.k.s. system and the c.g.s. system, and all necessary information for the conversion of c.g.s. equations into m.k.s. terms. E.W.R.

New definition of the conception of elastic limit and yield point. W. SPÄTH. *Arch. Eisenhüttenwesen*, **16** [11/12] 465–68 (1943); abstracted in *Chem. Zentr.*, **1943, II** [23] 2098.—S. considers the usual determination of stresses that correspond to a permanent deformation to be inexact. The permissible permanent elongation can be brought in relation only with the elastic elongation with which the former must form a definite ratio. S. suggests the measurement of the plastic elongation in the purely plastic range that belongs to the respective stress; this requires the determination of the elasticity modulus. The values found in this manner have the advantage that the ratio of permanent and elastic deformation remains constant and can be used for the comparison of materials with different elasticity moduli. M.HA.

New technique for quantitative spectrographic analysis by the arc method. M. N. THRUSTON. *Jour. Soc. Chem. Ind.* [London], **61** [9] 144–45 (1942).—Na, K, Ca, Mg, Mn, P, and B in small amounts were analyzed quickly with an accuracy of $\pm 5\%$, an electric arc being used in place of an oxy-coal-gas flame (Ramage method) to volatilize the substance from an impregnated spill of filter paper. L.R.B.

Notes on constitution of pyrometric cones. WILLIAM J. MCCAUGHEY AND JOHN M. NEFF. *Bull. Amer. Ceram. Soc.*, **23** [10] 373–78 (1944).—Reprints of the following papers are included: "Viscosity phenomena of the system $KAlSi_3O_8$–$NaAlSi_3O_8$ and of perthite at high temperatures," by Kôichi Kani (*Ceram. Abs.*, **16** [7] 224 (1937)) and "Viscosity measurements of the ternary system diopside–albite–anorthite at high temperatures," by Shukusuke Kôzu and Kôichi Kani, *Proc. Imp. Acad.* [Tokyo], **11** [9] 383–85 (Nov., 1935). 6 references, 1 figure.

Relations between the chemical composition and the viscosity of metallurgical slags, and their technical importance. H. HELLBRÜGGE AND K. ENDELL. *Arch. Eisenhüttenwesen*, **14**, 307–15 (Jan., 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 135A (1942).—The authors point out that the older conception of the occurrence of stoichiometric compounds in silicate melts has been replaced by the assumption of far-reaching electrolytic dissociation in the melt. On the basis of their experiments and data from the literature, they enumerate the following factors as affecting the viscosity of silicate melts: the number of cations built into the silica lattice, the ion radii and the valencies of the cations, the valency of cations in the anion complex, the number of voids in the SiO_4-tetrahedron structure, and the oxygen-silicon ratio. Preliminary experiments indicated that the anions also have some effect on the viscosity. The replacement of metal oxides by equivalent quantities of fluorides or chlorides resulted in considerable decrease in the viscosity. By the examination of experimental melts in which the lime was replaced by magnesia and by the evaluation of data obtained by McCaffery for the viscosity in the system MgO–CaO–Al_2O_3–SiO_2 (*Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 383 (1931)), the authors proved that Endell and Brinkmann's formula (*Ceram. Abs.*, **19** [8] 201 (1940)), which enables a conclusion regarding the viscosity to be drawn from the composition, is applicable to all blast-furnace slags of normal composition, provided that the characteristic viscosity number (*Zähigkeitskennzahl*) is within the range 0.5 to 2. (The characteristic viscosity number, a criterion introduced by Endell and Brinkmann, is the ratio of the sum (in weight %) of the oxides, fluorides, and sulfides decreasing the viscosity coefficient at 1400°C. to the sum, also in weight %, of the oxides increasing this value.) The authors suggest a simplified equation which allows the approximate calculation of the viscosity at 1400°C. direct from the sum (in weight %) of $SiO_2 + Al_2O_3$. Their attempt to apply Brinkmann and Endell's equation also to open-hearth slags proved a failure, which they think to be due to the fact that these slags do not consist of a silicate structure. They briefly explain the effect of the electrolytic dissociation of silicate melts on the course of various metallurgical reactions such as deoxidation, dephosphorization, and desulfurization.

Relations between oxygen pressure, temperature, and composition in the system Fe_2O_3–Fe_3O_4. N. G. SCHMAHL. *Z. Elektrochem.*, **47**, 821–35 (Dec., 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **146** [2] 166A (1942).—After a detailed review of the literature on the hematite-magnetite system, S. reports on his study of the system by isothermal decomposition at various temperatures between 1290° and 1410°C. On the basis of his results he suggests some modifications of White's Fe_2O_3–Fe_3O_4 phase diagram (*Iron & Steel Inst.* [London], *Carnegie Schol. Mem.*, **27**, pp. 1–75 (1938)), especially with regard to the phase boundaries in the solid state. To demonstrate the effect of the oxygen pressure on the equilibrium in the system, S. includes two isobars in his diagram, viz., those for oxygen pressures of 159 and 760 mm. of mercury.

Significance of topochemical factors on rate of reactions between solid salts. GUNTHER COHN. *Jour. Amer. Ceram. Soc.*, **27** [10] 308–16 (1944).—20 references, 10 illustrations.

Sintering of aluminous minerals and silts of natural

molding sands in the heating electron microscope. M. VON ARDENNE AND K. ENDELL. *Giesserei*, **30**, 6–12 (Jan. 8, 1943); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 153A (1943).—The authors describe the method by which a magnetic electron microscope was fitted with a specimen carrier which could be heated by an electric current passing through a platinum wire. Instead of using a plate camera, a vacuum-film camera was fitted. With this apparatus the progress of sintering of suspensions of foundry sand at temperatures up to 1600°C. was followed by obtaining a series of pictures at 4000 diameters. Many of these are reproduced. Conclusions are as follows: (1) There is no relationship between the amount of fluxing material present and the temperature at which sintering begins, nor does the amount of flux affect the viscosity of the resulting melt. (2) The individual effect of the cations is the determining factor. (3) At the same temperature and concentration (in weight %) and with the same weight % of SiO_2 + Al_2O_3, potash makes viscous melts, and ferrous oxide thin melts.

Some factors affecting automatic pH control. W. N. GREER AND A. L. CHAPLIN. *Trans. Electrochem. Soc.*, **83**, 67–74 (1943).—There are certain factors, exclusive of the equipment to be used, which should be considered in applying automatic pH-control equipment to an industrial process. Some of these factors are appreciated by those familiar with control processes, but they are too often overlooked by the uninitiated. An uncontrollable process cannot be controlled with the best of equipment. The purpose of the authors is to develop equations which show what happens, in a more or less standard system, when a given change takes place in the process and before any control equipment can operate to make proper corrections. The effects of rate of flow, volume of reaction tank, time, and buffer index on the change in pH of a controlled process are considered. Illustrated. F.G.H.

Studies of portions of the quaternary system soda–lime–silica–water at 25°C. GEORGE L. KALOUSEK. *Jour. Research Nat. Bur. Standards*, **32** [6] 285–302 (1944); RP 1590. Price 10¢.—A study was made of portions of the system soda–lime–silica–water at 25°C. The only solid phases found were $Ca(OH)_2$ and a four-component gel of variable composition. The boundary, $Ca(OH)_2$—soda-lime-silicate gels, was determined, and the compositions of the gels along this boundary were shown to vary from $0.003Na_2O:2.0CaO:1.0SiO_2:xH_2O$ (at 0.2 gm. of Na_2O per liter) to about $0.25Na_2O:1.0CaO:1.0SiO_2:xH_2O$ (at 20 gm. per liter and extending to 101 gm. per liter of Na_2O). In regions off the boundary, at selected constant concentrations of Na_2O but with increasing concentrations of SiO_2 in solution, the $Na_2O:SiO_2$ molar ratio of the gels varied only slightly from 0.2 in most cases; the $CaO:SiO_2$ molar ratio, however, decreased to values approaching 0.1 at the maximum concentrations of SiO_2 used. Interpretations pertaining to relations between the compositions of the gels and solutions are given. R.A.H.

Suggestions for improving engineering textbooks in which coordinates are used. E. A. HERTZLER. *Jour. Eng. Education*, [N.S.] **31** [9] 660–67 (1941).—H. points out that there are many misstatements in textbooks in analytical geometry, calculus, differential equations, and engineering concerning the use of coordinates. While quite obvious to the engineer, they cause students much difficulty. Rules for the use of terms and the labeling of graphs are given. E.W.R.

Surface measurement by van der Waals adsorption. A. M. GAUDIN AND F. W. BOWDISH. *Amer. Inst. Mining Met. Engrs. Tech. Pub.*, No. 1666; *Mining Tech.*, **8** [3] 6 pp. (1944).—The method consists in determining the amount of nitrogen that is adsorbed by a given sample at the temperature of boiling nitrogen. Because it is adsorbed as an incomplete layer, it is necessary to determine the adsorption at three different nitrogen pressures. The sample is placed in a bulb and evacuated. A known volume of helium is introduced, and the pressure is measured; it is not adsorbed, but it is used to allow the calculation of a dead-space factor. The helium is removed, and nitrogen in known volume is put in. From the pressure, the amount of nitrogen adsorbed can be calculated. Glass spheres about 12 microns in diameter were used to calibrate the device. The area for one adsorbed nitrogen molecule was found to be 13.8 $a.u.^2$ A minus 400-mesh quartz sample had a surface area of 3610 sq. cm. per gm. A magnetic iron oxide powder which appeared too coarse had a surface of 60,000 sq. cm. per gm. This method must also measure internal cracks or pores. W.D.F.

Theory and practical application of polarographic analysis. G. H. JEFFERY. *Sheet Metal Inds.*, **16**, 1525–30, 1549 (Oct., 1942); abstracted in *Jour. Iron & Steel Inst.* [London], **147** [1] 68A (1943).—J. gives a comprehensive explanation of the theory of polarographic analysis; describes the apparatus, the preparation of the cells, and the calibration of a polarograph; and discusses its applications.

Use of fluorspar in the analysis of ferrous oxide in acid open-hearth slags. S. V. BUDAEV. *Zavodskaya Lab.*, **1940**, No. 7, pp. 792–93; abstracted in *Jour. Iron & Steel Inst.* [London], **145** [1] 167A (1942).—The use of hydrofluoric acid or potassium ammonium fluoride for the solution of acid open-hearth slags that are difficult to dissolve is unpleasant and also results in attack of the glass apparatus. These drawbacks can be avoided by using sulfuric acid to which fluorspar has been added to dissolve the slag. The hydrofluoric acid formed reacts with the silica in the slag to give volatile silicon fluoride, while the finely divided calcium sulfate formed deposits in a thin coating on the walls of the flask and protects the glass against attack. Experiments showed that this procedure had no effect on the accuracy of the analysis.

Vapor pressures, heats of vaporization, and entropies of some alkali halides. B. H. ZIMM AND J. E. MAYER. *Jour. Chem. Phys.*, **12** [9] 362–69 (1944).—Vapor pressures of crystalline KCl, KBr, KI, and NaCl have been measured in the pressure range of 10^{-1} to 10^{-7} mm. by a surface ionization method. Heats and entropies of vaporization are calculated from the data. The heats of vaporization at 0°K. and entropies at 298°K. are also calculated. From the data, saturated KCl vapor is shown to be less than 2% associated at 800°K., and the heat of dissociation of $(KCl)_2$ is shown to be less than 47 Cal. G.A.K.

Whither graduate research? Graduate engineering theses submitted in American schools in 1939. COMMITTEE ON ENGINEERING RESEARCH OF SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION. *Jour. Eng. Education*, [N.S.] **31** [7] 499–531; [8] 586–610 (1941).—The Committee has gathered together the titles of 1141 graduate engineering theses from 73 colleges and universities in the U. S. and Canada. These titles are listed under six major groups according to subject matter: (1) chemical engineering, (2) civil engineering, (3) electrical engineering, (4) mechanical engineering, (5) engineering mechanics and mathematics, and (6) mining engineering and allied fields (including ceramic engineering). Under each group there is an alphabetical listing of schools submitting titles in that group and the titles themselves from each school. These thesis titles may be of considerable value to research workers as a kind of yardstick by which each person directing graduate research may take stock of his own activities in the field. The mere listing and classification of these titles may supplement information desired in emergency training and research programs as to types of projects, laboratory facilities, and direction and working personnel. The committee has undertaken this job because a list of unpublished researches may be helpful in locating potential research workers and research facilities in relation to national defense and may serve as a stimulus for improvement to each individual supervisor of graduate student research. Of the 130 titles submitted in the mineral industries group, 23% were in ceramic engineering. A summary of the work includes the methods of obtaining the data, a general review, a breakdown of the data of each grouping into specific fields with percentages, aims, and acknowledgments, and a statistical summary according to schools. E.W.R.

You and research. T. A. BOYD. *Jour. Eng. Education*, [N.S.] **31** [8] 574–85 (1941).—B. presents a summation of

the aims and activities of research organizations and the type of men needed in research. Many interesting facts are given concerning industrial research and its methods, and the meaning of the term "scientific method" is discussed. E.W.R.

SEPARATE PUBLICATIONS

Adsorption of Gases and Vapors: Vol. I. STEPHEN BRUNAUER. Princeton University Press, Princeton, N. J., 1943. 511 pp. Price $7.50. Reviewed in *Chem. & Eng. News*, **21** [22] 1970 (1943). F.G.H.

Differential Thermal Analysis of Quartz. LOUIS H. BERKELHAMER. *U. S. Bur. Mines Rept. Investigations*, No. 3763, 18 pp. Free.—Quartz is readily detected by means of a differential thermal analysis procedure, which is described. This form of analysis is a relatively simple, rapid, inexpensive procedure, requiring ordinary skill; it has the advantage of eliminating personal error from an analysis. R.A.H.

Illustrated Technical Dictionary. Edited by MAXIM NEWMARK. Philosophical Library, New York, 1944. 352 pp. Price $5.00. Reviewed in *Chem. & Eng. News*, **22** [7] 547 (1944). F.G.H.

Lange's Handbook of Chemistry. Edited by NORBERT ADOLPH LANGE. Handbook Publishers, Inc., Sandusky, Ohio, 1944. 5th ed., 1777 pp. Price $6.00. Reviewed in *Chem. & Eng. News*, **22** [10] 846 (1944). F.G.H.

Practical Emulsions. H. BENNETT. Chemical Publishing Co., Brooklyn, 1943. 462 pp. Price $5.00. Reviewed in *Chem. & Eng. News*, **21** [17] 1466 (1943). F.G.H.

Ten Lectures on Theoretical Rheology. MARKUS REINER. Nordemann Publishing Co., Inc., New York, 1943. 163 pp. Price $4.50. Reviewed in *Chem. & Eng. News*, **22** [10] 848 (1944). F.G.H.

PATENTS

Manufacture of calcium carbonate. W. P. FOSTER AND IMPERIAL CHEMICAL INDUSTRIES, LTD. Brit. 563,111, Aug. 10, 1944 (Sept. 14, 1942).

Preparation of zirconium oxide. C. E. EVERY (Titanium Alloy Mfg. Co.). Brit. 562,620, July 19, 1944 (Jan. 6, 1943).

Titanium oxide pigment production. J. L. KEATS AND J. E. BOOGE (E. I. du Pont de Nemours & Co.). U. S. 2,358,167, Sept. 12, 1944 (Dec. 17, 1940).—A process for obtaining a rutile TiO_2 pigment by converting anatase which comprises subjecting a peptized TiO_2 mixture consisting of a purified anatase hydrolysate and about 20 to 40% of a purified rutile hydrolysate to treatment for a period of about 1 hr. at a temperature ranging from about 200° to 350°C. and under a superatmospheric pressure, while in an aqueous medium containing about 50 to 100 gm. per liter of hydrochloric acid, recovering and purifying the resulting rutile product, and then drying it at a temperature not exceeding 500°C.

General

Air compressors: IV, Putting air to work. C. W. GIBBS. *Pit & Quarry*, **37** [2] 48–51 (1944).—In general, two things operate to prevent the most effective use of air: loss of air through leakage and excessive pressure loss. Tool maintenance, air leaks, water in air lines, improper hose connections, and improper hose and pipe sizes all tend to reduce the efficiency of the compressor system. 2 diagrams, 11 photographs. For Parts II and III see *Ceram. Abs.*, **23** [5] 92 (1944). M.R.

Are air receivers safe? A. CARTER. *Nat. Engr.*, **48** [7] 461, 463 (1944).—C. points out some serious mistakes made in setting up air receivers. Proper placement of the receivers will result in their longer life with greater safety for operators. M.R.

Automatic dust handling in tile plants. L. BULLIN. *Trans. Brit. Ceram. Soc.*, **43** [3] 58–62 (1944).—B. describes a modern layout for the grinding and distribution of tile dust. The process is carried out in a mass-production factory of Richards Tiles, Ltd., Tunstall, Stoke-on-Trent, built nine years ago. R.A.H.

British resources of steel molding sands: I, Upper Carboniferous grits and sandstones of the eastern part of the Peak District. W. DAVIES AND W. J. REES. *Jour. Iron & Steel Inst.* [London], **148** [2] 11–62P (1943).—In the First Report of the Molding Materials Sub-Committee (Third Report of the Steel Castings Research Committee, *Iron & Steel Inst., Special Rept.*, No. 23, pp. 191–200 (1938)), attention was directed to the characteristics of certain crushed grits. In view of the possible usefulness of several of the grits examined then for the preparation of molding materials for the steel foundry, it was considered desirable to make a more complete investigation of the grits and sandstones accessible to steel-making districts. Part I deals with the Upper Carboniferous grits and sandstones of the Peak District, which is within easy reach of Sheffield, Lancashire, and the Midlands; in subsequent parts, the grits, etc., of other areas are dealt with. Attention is directed to the relationship between the petrology and the molding characteristics of grits. From a petrological examination to determine the mineralogical composition (by micrometric analysis) and the microstructure, useful indications can be obtained of the form of the mechanical-grading curve, the green strength and permeability, and the refractoriness. The important petrological features of the type of grit likely to be suitable for steel-molding purposes are as follows: (*a*) The grain size should be uniform (0.3 to 1.0 mm.). (*b*) Suturing in the quartzitic aggregates should be simple, so that the proportion of composite grains in the crushed material will be small. It is also desirable that the quartz grains should be free from strain. (*c*) The quartz content should be not less than 80%. (*d*) The content of sericite and kaolin should not be high, because of their effect in increasing sinterability; the presence of some limonite is advantageous, but its proportion should not be high. A feldspar content as high as 10% may not be detrimental if it is fresh, although a high feldspar content reduces the ultimate refractoriness of the crushed grit. Certain of the crushed grits have characteristics similar to those of synthetic molding materials, based on high-silica sands, at present used in steel foundries. **II, Lower Carboniferous sandstones of Rothbury Forest and Alnwick Moor, Northumberland.** *Ibid.*, pp. 63–80P.—These sandstones occur within easy reach of the Tyneside foundries. Geologically, they can be referred to two groups, viz., the Fell Sandstone Group and the Scremerston Coal Group. The sandstones of the former group are so friable that in many cases they can be crushed between the finger and thumb; the resultant sand contains 95% or more quartz. By simple washing, the quartz content can be increased to more than 98%. Consequently, the Fell sandstones are of particular interest as a source of high-silica sand. The sandstones of the Scremerston Coal Group in this area are, in general, too fine-grained and compact to be of use for steel molding, though one (R_2), from near Rothbury may be of service. **III, Moor grit of northeast Yorkshire.** *Ibid.*, pp. 80–97P.—This grit occurs within easy reach of the Tees-side foundries. Two types of grit may be distinguished, viz., feldspathic and quartzitic. Certain of the occurrences of the feldspathic type are sufficiently coarse to be suitable for use as steel-molding sands; details of their molding properties are given. The texture of the quartzitic type varies from open to compact. The former variety can be crushed easily to yield a high-silica sand suitable for use in iron and steel foundries. The latter variety is of little interest for molding-sand purposes, as it is difficult to crush and the grading of the resultant sand is unsuitable. **IV, Rotten-rock molding sands about Wolsingham, County Durham.** *Ibid.*, pp. 97–104P.—These friable sandstones are extensively worked for the production of naturally bonded molding sands for use in the steel foundries of

Tees-side and Tyneside and elsewhere. This preliminary paper describes the bonding properties of some of these sands. Attention is directed to the importance of the mineral constitution of the bond; it is indicated that a hydrobiotite bond is preferable to a sericite bond. V, **Permian yellow sands of Durham and Yorkshire.** *Ibid.*, pp. 104–11P.—These sands have been exploited for use as iron-molding sands, but they have rarely been employed for steel molding, as many of the occurrences are not sufficiently refractory. It is possible that the more refractory occurrences included in this account could be utilized in steel-molding sands with the addition of bonding clay. 20 references, 70 figures.

Business training for engineers. H. B. Cooley. *Jour. Eng. Education,* [N.S.] **31** [9] 654–59 (1941).—The engineer has a decided handicap in his work without some knowledge of business. A survey course in business, covering the basic principles of business organization, finance, accounting, statistics, marketing, insurance, and transportation, could be presented in a 3-hr., 1-semester course and would provide the engineer with the minimum necessary knowledge. E.W.R.

Ceramics at University of Illinois. R. L. Cook. *Bull. Amer. Ceram. Soc.,* **23** [10] 394 (1944).

College interest in instruments challenges responsibility of industry. Earl M. Robinson. *Finish,* **1** [5] 23–24 (1944).—The rapid growth of instrumentation in industry has resulted in an increasing interest in the universities in offering courses in the subject. Lack of time in college curricula, lack of instrumentation experts for instructors, and inadequacy of equipment are cited as obstacles to this end. The development and present status of the Brown Instrument Co. school are described briefly. V.D.F.

Conveyer belting. Anon. *Mech. Handling,* **31** [8] 397 (1944).—A new type of belt conveyer in which strands of light flexible cable replace cotton is discussed. The cable is covered with rubber, and the resulting belt is particularly advantageous for long hauls and for handling sticky or lumpy materials, earth, fill, etc. M.R.

Dust-collecting systems. F. C. Morey. *Iron & Steel Engr.,* **21** [7] 45–51 (1944).—M. summarizes recommended practice in the design and operation of grinders, mixers, crushers, etc. B.L.

Dust extraction in steel foundries. Editorial. *Foundry Trade Jour.,* **73** [1462] 327 (1944).—The Ministry of Health report on free silica in steel foundries is discussed. A.B.

Elevated temperature studies of foundry cores and core-making materials. E. Pragoff, Jr., and C. P. Albus. *Trans. Amer. Foundrymen's Assn.,* **51** [4] 935–74 (1944).—Studies are presented on the hot strength, retained strength, and expansion of two types of sand cores commonly used in foundry practice: (1) new sand cores, bonded with organic binders, no clay being present, and (2) black-sand cores, prepared from sands containing clay, bonded with organic binders. Hot-strength curves from data obtained are plotted for both types. The effect of heating cores for various soaking periods at various temperatures is shown to illustrate the rate of breakdown of organic binders as core temperature rises. Data are presented on the retained strength of cores bonded with various binders. A method for determining hindered expansion of sand cores is described, which can be used only for control testing on black-sand cores. Graphically, the effect of each ingredient, in a core mixture for steel castings, on the hot and retained strengths of the mixture is illustrated. Two examples of practical foundry problems, which were solved by the application of sand control using elevated temperature tests to indicate the logical core-making materials to provide improved core knock-out, are described. M.A.S.

Engineer in the federal service. E. J. Stocking. *Jour. Eng. Education,* [N.S.] **31** [7] 487–98 (1941).—S. gives a brief history of Civil Service, followed by a description of the types of work done by engineers in federal service and the methods used in examining applicants. Recommendations are made to engineers who desire to apply for federal positions. E.W.R.

Engineer in a postwar world. H. T. Heald. *Jour. Eng. Education,* [N.S.] **32** [4] 305–306 (1941).—H. discusses the position of engineers in the postwar period and the changes which should take place in engineering curricula to better fit the new graduate into his position. E.W.R.

Engineering materials. Alfred H. White. *Jour. Eng. Education,* [N.S.] **32** [2] 148–53 (1941).—W. points out that the engineer deals mainly with materials and forces. The inadequacy of materials is one of the main hindrances to progress in engineering of almost any type. There should be included in the engineering curriculum a course in engineering materials. W. outlines the contents of such a course given to freshmen at the University of Michigan and finds it satisfactory. See *Ceram. Abs.,* **19** [1] 35 (1940). E.W.R.

Engineering, science, and management defense training. R. A. Seaton. *Jour. Eng. Education,* [N.S.] **32** [2] 104–25 (1941).—A series of 47 questions and their answers are given on all phases of the engineering, science, and management defense training program, particularly to guide colleges and universities participating or considering participation in the program. E.W.R.

Engineering students and the emergency. Donald B. Prentice. *Jour. Eng. Education,* [N.S.] **31** [6] 3–4 (1941).—P. urges engineering teachers and administrators to encourage their engineering students to remain in college, to ask for deferment under the draft, and not to consider voluntary enlistment. E.W.R.

Explosives remove a smokestack. L. W. Early. *Explosives Engr.,* **22** [4] 162–63 (1944).—A smokestack made of red brick, 125 ft. high, 8 ft. in diameter at the bottom, and with walls 1 ft. thick, was brought down with dynamite. Brick were removed at the base of the stack in the shape of a wedge, and in their place timbers were inserted to support the stack. Two shots of dynamite were placed in each timber, and two shots were loaded in two holes in the brick to blast out the narrowed area of the wedge. Illustrated. G.A.K.

Formation of dust clouds in an experimental duct. N. M. Potter. *Colliery Guardian,* **169,** 183–89 (1944).—The purpose of this work was to determine the subsequent history of dust particles once they have been set in motion. The duct was made of metal, 6 in. square and 30 ft. long. The dust was placed inside on the bottom and set in motion by an instantaneous blast of air. Sampling was done by means of a tube or two kinds of traps. Conclusions are as follows: (1) Stone and coal dusts contribute to the rate of cloud formation at similar rates. (2) The distribution of the dust concentration in an air-borne cloud at all stages appears to obey a logarithmic law. (3) The actual distribution of dusts of similar fineness will depend on the distance the cloud has and the degree of turbulence in the air stream. (4) Intimate mixtures of coal and inert dust behave in regard to both erosion and cloud formation in time and space as simple dusts. (5) The ease of movement of irregular surfaces when subjected to a blast is dependent on the bulk density of the dust and the degree of aggregation in the dust. (6) A cloud of fine dust in movement affects neither the erosion of similar dusts moved subsequently nor their rate of cloud formation. (7) In suppressing a coal-dust explosion, stone dust on the floor is relatively slow compared with that contributed from the roof and sides or from a preformed cloud. W.D.F.

Industrial view of college and post-college engineering education. R. C. Muir. *Jour. Eng. Education,* [N.S.] **31** [5] 412–20 (1941).—M. feels that the engineering student has not reached a degree of maturity where he is ready to assimilate and understand many of the broader aspects of business, economics, and human relations. The engineering curricula should consist mainly of fundamental teaching of physics, mathematics, and the physical sciences. Nonengineering courses should be held to a minimum, and their content should be adapted for maximum engineering utility. This is particularly true of

English and business courses, and a suggested business course is outlined briefly. The development of the engineering graduate into suitable material for managerial or executive positions can best be done by post-college engineering education, and a brief summary is made of the General Electric Co. plan for fitting the newly hired engineering graduate into the company. This plan consists of 12 to 15 months of classroom work in business and in electrical and mechanical engineering; in addition, all test work is carried out by these men, giving valuable training in responsibility. This course results in better placement and ability. E.W.R.

Instruction in industrial relations. JOHN W. RIEGEL. *Jour. Eng. Education*, [N.S.] **32** [3] 252–56 (1941). E.W.R.

Is your English short-circuited? W. GEORGE CROUCH AND M. L. MANNING. *Jour. Eng. Education*, [N.S.] **31** [9] 700–11 (1941).—The need for an adequate knowledge of English is often realized by the engineer only after he has been working in industry for several years. To meet this need, a post-graduate course in English, both written and oral, is suggested. Two questions are discussed in the light of what has been done during the past year in an English course given in the Transformer Division of the Westinghouse Electric & Mfg. Co., Sharon, Pa.: (1) What does the engineer need to know about English? (2) How may a course in English for graduate engineers be arranged to satisfy this need? A sound course in English for engineers is advocated to stimulate the interest of older as well as younger engineers in industry. A knowledge of the technique of the business letter, the engineering report, and the professional article is emphasized. The attainment of a rich and useful vocabulary by means of wide reading in scientific and humanistic articles and books is stressed, and the cultivation of effective oral English by much practice in public speaking is urged. The subject matter for such a course is discussed in detail, and its concrete results are evaluated. E.W.R.

Machine design as a medium for teaching engineering fundamentals. H. A. BOLZ. *Jour. Eng. Education*, [N.S.] **31** [5] 392–95 (1941).—The art of designing machines involves the application of mathematics, the laws of science, the principles of economics, and considerable analytic ability; hence a course in machine design can and should constitute an ideal means of teaching the fundamentals of engineering as well as the design of machines. E.W.R.

Mathematics of engineering. E. R. HEDRICK. *Jour. Eng. Education*, [N.S.] **32** [1] 57–66 (1941).—H. pleads against the elimination of mathematics courses from high-school curricula as is being done in the "progressive" schools. Tests of college students have shown a remarkably poor knowledge of elementary arithmetic and algebra. Nearly 60% of a group of over 4000 college students tested could not express $^7/_8$ as a decimal fraction. The ability to think quantitatively must be learned, particularly by high-school students intending to go on to engineering. Many startling examples of lack of sufficient mathematical groundwork in even the simplest and most basic principles of arithmetic and algebra among college men are given. A discussion is included. E.W.R.

Nationwide association of engineers favored. ANON. *Bull. Amer. Ceram. Soc.*, **23** [10] 394–95 (1944).

New adhesive means new market for whiteware, enamel, and glass tile. ANON. *Ceram. Ind.*, **43** [1] 25–27 (1944).—It is claimed that Miracle Adhesives, Newark, N. J., has produced a series of phenol-based plastics with a rubber filler that can be used for adhesives for indoor and outdoor applications with outstanding properties. 5 illustrations. H.T.

Objective quizzes in engineering. V. M. FAIRES. *Jour. Eng. Education*, [N.S.] **31** [4] 368 (1940); [5] 441 (1941).—With increasing enrollments and larger classes, there is a need for quizzes that can be graded quickly, possibly even by inexperienced help. F. feels that objective-type questions can be used advantageously in most engineering courses. Eight examples are given of several possible types of questions in the field of machine design. A cooperative effort should be made, as it is somewhat difficult to word questions unambiguously. In this manner all contributors could rapidly build up a file of suitable quiz material. E.W.R.

Our research system. HAROLD VAGTBORG. *Jour. Eng. Education*, [N.S.] **31** [5] 421–31 (1941).—V. traces the development of scientific research from its early beginnings with the cave man's accidental discovery of metals to the present. The Romans felt they were living in an era of highly developed culture and industrial progress, yet the developments of their era were the outgrowth of the discoveries of previous generations, just as the fruits of research today are the outgrowths of the discoveries of the past thousands of years. In 1939 there were almost 50,000 research workers in the U. S., and the research "industry" spent $250,000,000. The more obvious incentives for research include (1) success of past developments, (2) rapid growth in recent years of new industries, (3) appreciation of future possibilities by the use of newly available scientific tools, (4) the fact that research may hold the answer to the conservation of existing materials and certainly does for the development of new ones, (5) social aspects of research, (6) the fact that research is the life blood of our free competitive system, and (7) professional advancement and recognition. The nine classifications of research agencies and their location, objectives, and importance are given. They are (1) individuals, (2) companies, (3) associations, (4) consulting and testing laboratories, (5) research institutes, (6) foundations and councils, (7) societies, (8) Government bureaus, and (9) universities and colleges. E.W.R.

Physics of air flow and dust movement. N. M. POTTER. *Colliery Guardian*, **169**, 125–29, 157–60 (1944).—An endeavor has been made to show that in spite of the chaotic nature of individual eddies, the essential parameters of turbulent flow exhibit surprisingly constant characteristics. It is not unlikely that the movement of air in advance of an explosion is subject to the same laws as those applying to high speed air flow. The paths of dust particles, whether of coal or inert material, once in movement, are largely dependent on the random eddies in which they find themselves. W.D.F.

Physics in the engineering curriculum. E. U. CONDON. *Jour. Eng. Education*, [N.S.] **32** [1] 67–71 (1941).—Physicists and engineers should work together more than they do. There is too much feeling among physicists that they must avoid anything but pure science and a feeling among engineers that physicists are impractical. A good start has been made in the form of the *Journal of Applied Physics*, and the present emergency has put many physicists into military research projects, but there is still too much distinction between applied physicists and engineers. In reality they are very similar. C. feels that more of the basic subject matter of engineering should be presented from the viewpoint of the academic research physicist. E.W.R.

Pneumoconiosis. Report of committee on the treatment and rehabilitation of miners in the Wales region suffering from pneumoconiosis. ANON. Condensed in *Colliery Guardian*, **169**, 218–19 (1944).—Recommendations are as follows: (1) the early establishment of a treatment and research center, (2) initial and periodical clinical and X-ray examinations of miners and their correlation with a scientific assessment of dust concentration and constitution, (3) the provision of facilities for pathological research into dust changes in the lung, and (4) the establishment of a pneumoconiosis bureau with full powers to coordinate all work. W.D.F.

Practical applications of quarry safety standards. WILLIAM L. ROSCOE. *Excavating Engr.*, **38**, 354–57 (1944).—To protect a vertical overburden face, dump screenings over the edge of the high wall to form a windrow at the base. Do not let men near a quarry face even after scaling. Either undermine rocks with the shovel or leave them until the next advance. If necessary to drill at the face, put a tarpaulin over it. Do not use any dynamite with the nitroglycerin leaking out. Dynamite now made will not freeze in the U. S., but hardened dynamite may be

mistaken for it. A pin will penetrate the hardened type but not the frozen dynamite. Testing a blasting circuit with a galvanometer is suitable in a series circuit but useless for a parallel circuit. Toe hole drilling should be eliminated, as it is very hazardous; some faulty operating condition is responsible. Drill an extra vertical hole in line with the toe and ahead of the regular line of holes and load only the bottom of this hole. W.D.F.

Present status of "nontechnical" engineering education in American universities. R. H. ROWNTREE. *Jour. Eng. Education*, [N.S.] **32** [3] 215–23 (1941).—The present status of "nontechnical" courses in engineering curricula is given in the form of a statistical analysis of the 1939–1940 curricula of 40 institutions. The average time (of widely varying groups) devoted to "nontechnical" courses by engineering students is approximately 16%. E.W.R.

Presenting the case for the technical institute. PARKE R. KOLBE. *Jour. Eng. Education*, [N.S.] **32** [3] 247–51 (1941).—K. presents a plea for proper recognition of the graduates of a technical institute by Civil Service, state licensing boards for engineers, and industry. E.W.R.

Problems in secondary education that affect engineering colleges. FRANK B. LINDSAY. *Jour. Eng. Education*, [N.S.] **31** [7] 479–86 (1941).—An increase of industrial efficiency in the U. S. would lower costs and prices and increase consumption and production. Trained personnel shortages that exist today in defense industries are due to a defective educational foresight that dates from the years when both capital and labor throttled the development of comprehensive vocational education. There should be a careful study of the high-school student's physical, mental, and moral resources with the aim of better selection of material for higher education, particularly in the engineering curricula. High-school grades are not sufficiently indicative. The tremendous increase in high-school attendance in recent years has changed the main obligation of high schools from the preparation of students for college to the training of workmen for competency in applied technologies. The majority of the high-school population probably will not go to college, yet it is the high school's responsibility to guide those students who should go to college into a college preparatory curricula. A description is given of the high schools of California and some of the curricula. Attempts have been made to devise curricula so that capable youths may be located and segregated into special groups for rigorous training in preparation for college. By this means, the 15% of high-school graduates who go to college (and the 0.5% who enter engineering) will be better prepared for college, and the remainder will not be burdened with what is to them useless information. E.W.R.

Reclaiming foundry sand by the wet method. WILLIAM RENGERING AND WALTER HORTH. *Iron Age*, **154** [1] 68–74 (1944).—Tests indicate that reclaimed sand is at least as clean as new sand, since dry tensile values are equivalent and permeability is higher. E.H.McC.

Reducing production costs in the postwar period. LOUIS RUTHENBURG. *Enamelist*, **21** [6] 4–7; [7] 14–15, 52–55 (1944).—Recognizing the vital importance of restoring and maintaining a postwar economy of plenty with high productivity and employment levels, R. analyzes the factors involved in cost reduction and control. Cost-conscious product design, incentive wage systems, and employee-management relationships are discussed. V.D.F.

Relationship of cost accounting and engineering economy. BILLY E. GOETZ. *Jour. Eng. Education*, [N.S.] **31** [8] 611–22 (1941).—Cost accounting gathers data, and engineering economy interprets the data. The two should never have been considered or taught as separate subjects. A new cost accounting should begin with a careful consideration of the objectives, i.e., profit-making, rendering of best service for least cost, planning, policy making, execution, representation of the company to others, etc. Practically the whole literature of cost accounting should be rewritten. Many examples are given of incorrect cost accounting and its effect on the company, and recommendations for improvements are made. Tabulating equipment is recommended for the more involved work. Recommendations are also made concerning the content of cost-accounting courses for engineers. E.W.R.

Removes silica scale from cooling coils. F. B. VILLER. *Elec. World*, **121** [8] 671–72 (also separately paged in this number, 81–82) (1944).—A successful method of removing scale from transformer coils consists of three operations: (1) a solution made with 4.8 oz. of caustic chemical and 3.5 oz. of metaphosphate per gallon of water is circulated through the coils at 88°C. for 24 hr. The coils are dried by air blast for 15 to 20 min. and cooled to 50°C. (2) Coils are again dried by air for 5 min., the contraction of scale producing fissures penetrable by acid. (3) An acid solution (1 part hydrochloric acid of 35% strength to 3 parts of water, with 1 oz. of powdered Hibbitite for each gallon) is pumped through the coils. Foaming occurs, but decreases as fissures disappear, and the cycle is repeated. E.H.McC.

Repairs and maintenance: lubrication of conveyer and elevator chains. J. W. LEECH. *Mech. Handling*, **31** [7] 314–19 (1944).—L. points out the necessity of lubricating chain. He discusses the type or class of lubrication to be used and the method of applying it according to the working conditions encountered. A table of British lubricants is given. 3 diagrams, 1 photograph. M.R.

Report on Society for the Promotion of Engineering Education conference on soil mechanics and its applications. P. C. RUTLEDGE. *Jour. Eng. Education*, [N.S.] **31** [8] 559–65 (1941).—At the meeting held in September, 1940, at Purdue University, the subjects covered included applications of soil mechanics to foundation and highway engineering, the content of a course in soil mechanics and its position in the civil engineering curricula, methods of instruction, value of grain-size distribution and mechanical analysis in the identification and classification of soils, sampling of soils, shearing resistance of clays and testing methods for its determination, earth pressure on walls, the effect of surcharges on earth pressure, stability of slopes, stress distribution in soils under loaded areas, stress distribution around piles, pile-driving formulas, settlement problems, wheel load stress distribution, and specific methods of subgrade treatment and stabilization. E.W.R.

Research as a field for engineers. ALFRED H. WHITE. *Jour. Eng. Education*, [N.S.] **32** [3] 199–201 (1941).—Over 10% of the present engineering graduates go into research, and even greater numbers will enter it in the next decade. It is a field worthy of careful consideration by the better engineering students. E.W.R.

Scope of lighting in industry. J. H. NELSON. *Sheet Metal Inds.*, **19**, 101–108 (Jan.); 285–93 (Feb., 1944).—The importance of lighting is shown by the discussion of the results obtainable through the use of good lighting and by relating each result to the appropriate visual phenomenon as found in the laboratory. These discussions are then used as a background on which to build the concept of ideal seeing conditions. The relation of both lighting and decoration to the final result is discussed. In some cases stereoscopic pictures are used. A.B.

Selection of engineering students. RUSSELL S. BARTLETT. *Jour. Eng. Education*, [N.S.] **32** [3] 227–38 (1941).—The first aim of a program of student selection and guidance should be to place each student in the curriculum best fitted to his own peculiar tastes and abilities and to help him to work effectively in that curriculum. As a basis of selection, the rank in class in high school comes first and is more reliable if the high schools are rated. Selected tests of general aptitude and of achievement in specific subjects should be used to supplement high-school records. Even with the most careful selection, there appears to be a need for graded sections in many subjects of instruction, and substantial gains are apparent from such practice where the instruction is adjusted to the abilities of the class. For the work of such counselling service and for the selection process to be fully effective, there must be available somewhere a diversity of curricula, ranging over technical, engineering, and scientific courses. E.W.R.

Servel and the CED. LOUIS RUTHENBURG. *Enamelist*, **21** [8] 20–22 (1944).—The history of Servel, Inc., is de-

scribed in relation to its plans for postwar planning in accordance with the philosophy of the Committee for Economic Development. V.D.F.

Seven-year silicosis record. ANON. *O. I. C. Monitor*, **17** [9] 139 (1944).—On July 31, 1937, silicosis became a compensable occupational disease in Ohio. Up to July 31, 1944, a total of 1639 claims had been filed. Of these, 702 were allowed, 767 were disallowed, and 170 are still pending. In the ceramic field 222 claims were allowed. C.S.P.

Southern bentonite in the steel foundry. N. J. DUNBECK. *Trans. Amer. Foundrymen's Assn.*, **51** [4] 929–34 (1944).—D. compares southern and western bentonites in respect to properties conferred by them on sand used in steel foundries. The chief value of southern bentonite is in regulating dry and hot strengths. It gives higher flowability, easier shakeouts, and greater freedom from hot cracks and tears due to the sand. M.A.S.

Steam pressure reducing valves. J. J. WOOLFENDEN. *Heating, Piping & Air Conditioning*, **16** [6] 361–64; [7] 415–17 (1944).—W. discusses, from the user's viewpoint, the available types of steam pressure reducing valves and their proper selection. He describes three classes of valves, dwelling at length on diaphragms and the importance of valve-size selection. Valve capacity is discussed, and suggestions on installation are given. 3 diagrams. M.R.

Storage of explosives. F. A. SNYDER. *Safety Eng.*, **88** [2] 26–28 (1944).—The term "explosives," as used by S., covers TNT, dynamite, black blasting powder, pellet powder, blasting caps, fuse, electric blasting caps, primacord, cordeau, and Bickford and miners' squibs. The term "electric blasting caps" covers instantaneous electric blasting caps, delay electric blasting caps, delay electric igniters with blasting caps attached, and electric squibs. Magazines, methods of storing explosives, what must be stored in separate magazines, safety measures, and wearing apparel for use in magazines are discussed. It is urged that all those handling explosives be fully instructed in the laws and regulations regarding them. He further urges that no makeshift methods be tolerated. M.R.

Substitute core binder. A. SWAGERMAN. *Gieterij*, **17** [6] 55–58 (1943); abstracted in *Chem. Zentr.*, **1943, II** [22] 1999.—A substitute for the oil-containing core binders for sand cores used in foundries can be found in bituminous coal pitch (binder P) if a not too high grade material is required. Binders on an artificial resin basis (binder K) are also suitable but are at present not available. For certain special purposes, however, oil-containing binders cannot be dispensed with. M.HA.

Teaching engineering economy to engineering graduates in industry. DOUGLAS F. MINER. *Jour. Eng. Education*, [N.S.] **32** [2] 174–85 (1941).—"Cost-consciousness" is a required attribute for engineers engaged in industrial work, yet most do not receive training in engineering economy during their undergraduate years. M. gives a detailed outline of the contents of a course on "industrial economics and business methods" given as a post-graduate course with credit toward a master's degree by the University of Pittsburgh-Westinghouse Graduate Program and taken by engineering graduate employees of Westinghouse. The course is felt to be successful. E.W.R.

Terminology and specifications for comprehensive examinations in engineering. R. H. FRAZIER. *Jour. Eng. Education*, [N.S.] **32** [3] 239–46 (1941).—The development of comprehensive examinations has been somewhat difficult owing to the lack of a generally accepted terminology for describing the components of the examinations, their aims, uses, and particular characteristics. F. gives a list of terms and their definitions as accepted by the Society for the Promotion of Engineering Education. E.W.R.

Use incentive plans to boost production. E. MOTTERSHEAD. *Ceram. Ind.*, **43** [2] 43–44 (1944).—Incentive plans for ceramic plants are discussed. H.T.

When shall engineering economy be taught? (Discussion.) Edited by EUGENE L. GRANT. *Jour. Eng. Education*, [N.S.] **31** [5] 440 (1941).—Engineering economy deals with comparisons between technical alternatives in which the differences between the alternatives are expressed as far as practicable in money terms. This report of a panel discussion mentions the advantages of giving such a course as late in the curriculum as possible, as opposed to a suggestion that it be given to freshmen. E.W.R.

When should an engineer obtain a general education? ALFRED H. WHITE. *Jour. Eng. Education*, [N.S.] **32** [2] 101–103 (1941).—The engineer has been accused of lack of culture. This cannot be developed by the addition of two years of a general college course as a precedent to the engineering school as has been proposed but can be obtained only by self-improvement after graduation. E.W.R.

SEPARATE PUBLICATIONS

Burning Rate of Fuse. D. HARRINGTON AND R. G. WARNCKE. *U. S. Bur. Mines Information Circ.*, No. 7281. 10 pp. Free.—Examples of accidents that followed when blasters misjudged the burning rate of a fuse are given, and precautions to be used with fuses are stressed. R.A.H.

Careers and Mineral Industries. *Penna. State Coll. Bull.*, **38** [27] 24 pp. (July 2, 1944) (*School Mineral Inds. Circ.*, No. 17). Free.

Ceramic Data Book, 1944–1945. Industrial Publications, Inc., Chicago, 1944. 17th ed., 338 pp.—Thoroughly indexed, this edition contains a buyers' directory, catalogues of materials and equipment, ceramic publications, a list of ceramic books, and 115 pages of "editorial contents," covering process and equipment (25 pp.), power and power transmission (8 pp.), machinery and equipment (12 pp.), firing, fuels, and furnaces (17 pp.), drying (6 pp.), mathematics and conversion tables (6 pp.), chemistry and physics (7 pp.), kiln drawings and designs (9 pp.), enamels (7 pp.), glass (7 pp.), refractories (6 pp.), whiteware (4 pp.), and index (6 pp.). Altogether this data book is a valuable encyclopedic reservoir of ceramic data to all who are interested in ceramics, a textbook most valuable to students, to factory operators, and to craftsmen. For a purchasing agent it is his handy reference. R.C.P.

Handbook of Descriptions of Specialized Fields in Ceramic Engineering and Technology. Prepared by the National Roster of Scientific and Specialized Personnel, Bureau of Placement, War Manpower Commission, Sept., 1944. 16 pp. Reprinted in *Bull. Amer. Ceram. Soc.*, **23** [10] 397–401 (1944).

Procedure for Applying for Tests Made on Explosives and Blasting Devices by the Bureau of Mines. ANON. *U. S. Bur. Mines Schedule*, 1E, 16 pp. Supt. of Documents, Govt. Printing Office, Washington, D. C. Price 5¢.—Prescribed conditions and requirements for permissibility when used in coal mines and a schedule of fees for the tests are given. R.A.H.

Standard Construction of Mine Ventilating Doors. J. C. HARTLEY AND A. C. MOSCHETTI. *U. S. Bur. Mines Information Circ.*, No. 7280. 4 pp. Free.—Certain mining conditions, especially where the ventilation system is complex, necessitate the use of doors along haulageways for efficient coursing of air to the faces. Standardized construction of doors and door frames along haulageways in an anthracite colliery in Pennsylvania are described. R.A.H.

THE BULLETIN SECTION

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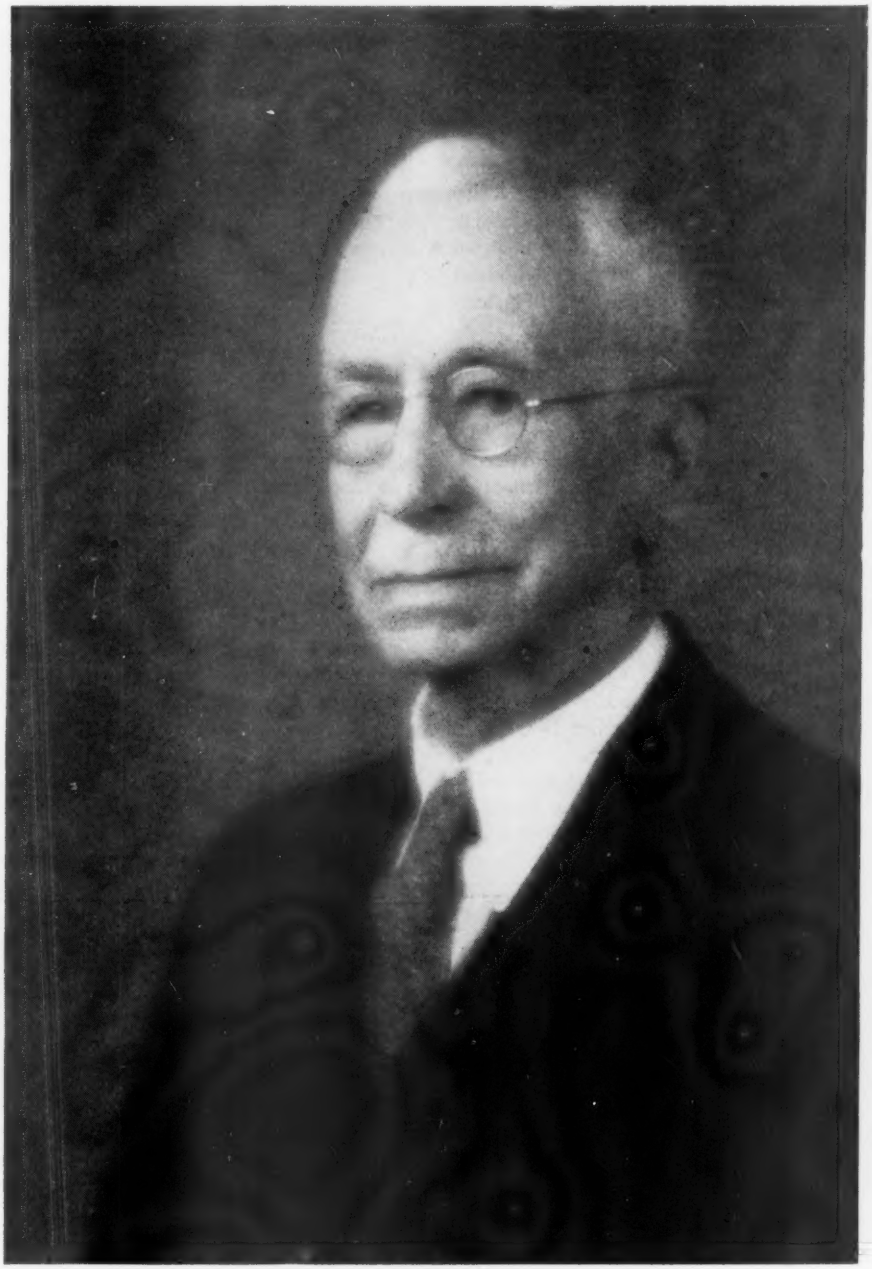


DAVIS BROWN
1944

TWENTIETH ANNIVERSARY OF THE DEVELOPMENT OF CLAY DEAIRING

A Tribute to Davis Brown

As in the production of liquid air, it was the practical mechanic who made a commercially successful equipment to perform what physicists and technologists had long been attempting. The value of deairing of clay had been well known and many industrial attempts had been made, but it was Davis Brown who was the first to develop the machine and process by which plastic clays were successfully deaired. Later he developed a method for deairing dry-pressed ware and pottery slips.

It seems incredible that the first work by Davis Brown on the deairing of clay was only twenty years ago. Twenty years is a short time when looking backward or forward. The rapid adoption of the deairing methods and the rapid development and perfection of equipment and the almost universal use of deairing makes it seem incredible that clay masses were not deaired by suction earlier than 1926.

The ceramic industry is indebted to Davis Brown. It is with pride that we now salute him with a brief biographical sketch and a story of his own, which he presented before our Southern California Local Section.

Davis Brown was born on a farm in Indiana August 18, 1860. He attended country school and high school at Portland, the county seat, and then completed a teacher's course at the late Liber College. He taught general subjects for two years.

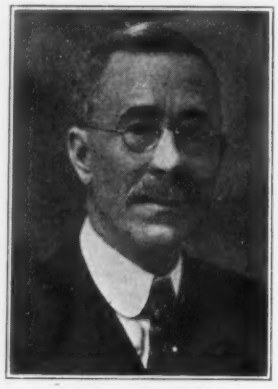
In 1881, he was hired by Frey, Sheckler & Hoover at Bucyrus, Ohio, as a machinist apprentice. At that time, his employers were beginning to manufacture brick and tile machinery, including the Tiffany Centennial. Part of his duties was tempering clay by the hand-shovel and sprinkling-can method for "testing" clays and dies, and he was soon given charge of that work.

Experience gained in operating the shop machine led to installing machinery, and he was sent to many states for this purpose, all of which was done during nonfreezing weather. During the winter months, he worked all over the shop at various tasks and became interested in mechanical drawing. Having naturally a mechanical inclination, he was able to suggest improvements and devices for the further mechanization of clayworking plants.

Encouraged by his employers, and with the assistance of F. E. Frey, senior member of the Company, he designed roll crushers, pug mills, a dry pan with a metal framework, and a power-driven repress known as the Eagle Repress, some of which are still in use.

About 1889, when twenty-nine years old, Davis moved to Portland, Indiana, where he operated a general repair shop and designed and built a brick and tile machine called the "Leader." He was then induced to move to Decatur, Illinois, into larger quarters. As he was overextended financially, the panic of 1893 made it necessary for him to turn over all of his interests to pay his debts.

Then he went with the late C. W. Raymond & Company, Dayton, Ohio, as engineer and superintendent. After two years with Raymond, he went with Chambers Brothers of Philadelphia, Pennsylvania, to be in charge of their Chicago office. Two years later, Davis found that he had to move to Carrol, Iowa, to assist his brother in putting his electric-light and heating station on its feet. With the plant in successful operation, he returned to his chosen line of work by joining the late H. Brewer & Company of Tecumseh, Michigan, as engineer and superintendent, redesigning and adding to their line. Here he remained for seven years, when an opening with a larger organization with greater responsibility and opportunities occurred and was accepted. Thus he was back at his starting place, the American Clay Machinery Company, Bucyrus, Ohio, successors to Frey, Sheckler & Hoover, in a greatly enlarged plant. Davis was now forty-six years old. He was made superintendent of the shops and engineer for ceramic machinery. Here he had a well-organized and well-equipped shop with plenty of skilled men and the going was good from the beginning. They completely redesigned and increased their line of ceramic machinery, making it stronger and more efficient.



Davis Brown
1925

The Hadfield-Penfield Steel Company purchased the American Clay Machinery Company. Previous to this change of management, Davis had changed over one of their largest machines, adapting it for extruding glass-tank or flux blocks. These blocks, made from refractory materials, are of relatively large cross section and are cut up into blocks, the maximum finished size being 12 by 24 by 60 inches. He encountered unexpected difficulties. The blocks first made would twist or "unwind" from stresses set up from the revolving auger. He finally overcame this, but the blocks still had voids, mostly near the surface.

By this time, their customer, the Buckeye Clay Pot Company, Toledo, Ohio, was becoming less optimistic about the success of the project but had the courage to continue experiments with changes in machine design. The trouble was diagnosed as entrapped air. They agreed to meet at the 1926 Meeting of The American Ceramic Society at Atlanta, Georgia, and decide what had best be done.

Before leaving for the Meeting, Davis had drawings made showing a machine hermetically sealed and a smaller machine to be used as a feeder, feeding through a seal or plug of clay with air exhausted from the main machine.

On arrival at the Meeting, they went over the drawings

and Davis was given the go-ahead signal; within six or eight weeks the first deairing extrusion unit was in successful factory operation.

They applied for a patent covering it only to find that George Staley had already been allowed a patent covering the fundamental principle of deairing and that the patent had expired.

At this time, the clay-machine company had become the W. A. Riddell Company.

After the amazing results from removing air from clay, Davis became enthused to the extent of using his utmost efforts to induce the Company to redesign its combined machines and incorporate deairing. This they did not do. He then asked for an understudy to take over his work. The W. A. Riddell Company finally acquiesced to Davis' proposal, with the understanding that he would represent them on the West Coast, using half his time only; the other half was to be devoted to private consultations. This did not work out very well, so Davis engaged in business for himself.

It was found difficult to put over deairing at that time until his very good friend, B. F. Cake, vice-president of Gladding, McBean & Company, Los Angeles, California, became interested and authorized him to combine two of their idle machines to extrude terra-cotta blocks. Space does not permit describing the amazement and gratification of the entire personnel of this Company when witnessing the performance of this second deairing unit.

Gladding, McBean & Company was sufficiently magnanimous to open its doors and show this unit in operation to many manufacturers of ceramic ware, with the result that Davis had plenty of business and the depression failed to overtake him.

After having made about a dozen such conversions, including sewer-pipe presses, Davis contacted the Bonnot Company of Canton, Ohio, and made amicable arrangements with them for the use of such patents as were pending at the time and to assist in the design of a combined mixing-deairing extrusion machine. The rest of the story is common knowledge.

The few patents granted to Davis while he was employed were assigned to his employers. He patented a grinder which is a streamlined dry pan occupying considerably less space and using much less power than the conventional dry pan.

He patented a device and method for heating the augers of extrusion machines for extruding materials that solidify at ordinary temperatures (patent No. 1,788,821). There were several in use extruding expansion strips for concrete-surfaced highways, carbon pencils, brushes, and electrodes.

During World War I, he patented a nosing device for pointing projectiles.

He also patented an automatic cutter for cutting, forming, trimming, punching, and labeling mission and Spanish tile, which is in general use on the West Coast, some in the Central States, and some abroad; also an automatic former and cutter for making a lightweight reinforced tapered clay shingle and an automatic former and cutter for a lightweight side-lock shingle with closed end. Both the latter patents are owned by local and eastern manufacturers; the patent numbers are 1,894,394, 2,113,717, 2,177,607, and 2,205,080.

Laboratory-size slip deairing unit

Patents relating to deairing are Nos. 1,987,359 and 2,005,886. Patents for a potter's pug mill (No. 2,213,381), a deairing agitator for slip (No. 2,183,763), and a pug-mill tender (Nos. 2,102,584, and 1,907,731) were also issued to Davis Brown.

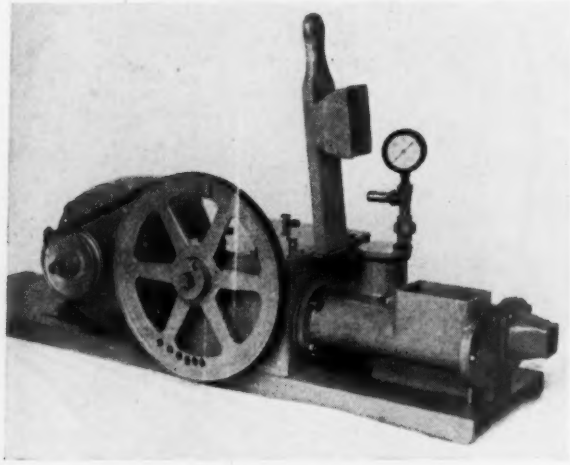
Almost all of his patents have been sold; also most of them are already in successful operation and all will be available to the ceramic industry once the war is won.

There are several of his designs in factory use that have not been patented, including a general-purpose hydraulically operated and electrically controlled automatic cutter, which cuts standard-size brick and blocks up to 15 by 15 inches in cross section and has an adjustable cutting stroke and adjustable wire-holder bars for different length wires, and a hydraulic repress for medium and large blocks, which presses from the top and bottom surfaces simultaneously.

Davis Brown is enjoying a consultant practice here and abroad. He writes as follows: "It is very gratifying to me to feel that I have been the means of contributing some-

thing to the industry which has patronized and borne with me so many years and which has been and still is a great pleasure to serve."

The deairing of plastic, semidry, and clay slip is a monumental contribution to ceramics by Davis Brown. Many have made improvements on his devices and procedures, but the distinction of being the first to successfully deair clay products belongs to Davis Brown. Davis Brown tells of his work in a paper read before the Southern California Section of the American Ceramic Society in 1934. This paper follows:



Laboratory-size deairing extrusion unit with die for standard test bar. Can be cleaned and reassembled in 15 minutes when changing mixes. Used by the U. S. Bureau of Mines, the General Electric Company, the Georgia Kaolin Company, and many others.

COMMERCIAL DEAIRING OF CLAYS

By Davis Brown

Introduction

It is well known that the presence of air in clay lowers plasticity, produces air voids and blisters, and causes a differential flow of material through extensions and dies, producing laminations. Manufacturers of the finer and lighter clayware used to work out air by what is known as "wedging," by aging, or by repeated pugging—methods too slow and expensive, especially for the manufacturer of heavier clayware.

Laboratory experiments with deairing clays conducted at various times by Messrs. Brand, Lovejoy, and others revealed wonderful possibilities for improvement in all clayware by the removal of air, provided it could be done economically and at a reasonable cost for equipment. That efforts had been made to deair clay as early as 1902 are revealed by copy of a patent granted to Raleigh H. Staley. A patent was granted to J. J. F. Brand in 1919. But probably owing to the fact that results obtained from deairing are so marvelous as to test the credulity of the average man, deairing did not come into general use until late years.

Part of my duties for many years consisted in servicing clayworking machinery. I was expected to make machinery perform the work for which it was intended, and now, since the advent of deairing, I am wondering how we got by for so long a time without it. It was in my line of duties that deairing became a necessity and a commercial success.

The First Installations

Sometime around 1924, we undertook to produce glass-tank blocks made by extruding them through a die, using an auger machine, just like they make brick. These blocks are made from refractory materials in various sizes up to 12 by 24 inches in cross sections and as long as 60 inches when fired. This involved considerable investment and numerous experiments until 1926, when deairing came to the rescue.

The opportunity to again install deairing did not come until 1932. That deairing is rapidly coming into its own is largely due to the generosity and broad-mindedness of manufacturers in the Los Angeles district in making known its merits by exhibiting results to all comers.

The installations made in 1926 in Ohio and in 1932 at Gladding, McBean & Company were, so far as I know, the first and only ones in commercial use up to that time (1932). Since then and during the depression, there have been numerous installations of deairing units in the manufacture of practically every kind of clayware, including porcelain.

Credit is due Gladding, McBean & Company for having sufficient confidence to invest their money in what to them was an experiment and to make known the results of the first commercial deairing unit on the West Coast, and the second one in existence at that time. They advised the trade as to what might be expected from its use. The Batchelder-Wilson Company installed deairing soon afterward and put through clays for other manufacturers as trials. Results obtained from these installations interested an eastern machinery manufacturer. At this time (1934), there must be approximately 200 deairing units used in the United States and others in foreign countries.

Description of Early Machine Setup

Early installations were made by combining two auger machines, using one as a feeder and the other as a deairing extrusion machine. Machine No. 1, the feeding unit, was joined to machine No. 2 at one side of the hopper and forced clay through a tube, which served as a seal, into the hopper of machine No. 2. Machine No. 2 was hermetically sealed at all joints, including bearings.

The hopper was covered, and from any convenient point above the clay line a connection was made to a vacuum pump for exhausting the air.

For machine No. 2, I invariably selected one having knives in the barrel to cut up the clay as it entered the hopper, thus greatly facilitating the removal of air. As this requires that machines be set at right angles to each other, each machine is driven separately, but I have worked out a method for more satisfactorily driving both units with one belt.

For removing the maximum amount of air, the clay must be finely divided as it enters the vacuum chamber, which in this case is the hopper and barrel section of the machine. This may be done by forcing it through numerous small holes or by shredding it as it enters. Shredding of the clay is preferable as it does not compact the clay so much

and assists in the rapid separation and removal of its air.

For creating the vacuum, ordinary air compressors have been used by connecting the suction side of the cylinder to the hopper of the machine and exhausting into the atmosphere. A vacuum pump, however, is better and less expensive.

For most ware and with the majority of clays, it is desirable to remove as much of the air as possible. Rarely is an exception found. There are, however, certain clays that are very lean and correspondingly low in plasticity, so much so that heretofore it has been necessary to add plastic material. Such clays become quite plastic when deaired and may be used alone when part of the air is removed, yet when too great an amount is removed they are difficult to dry at the regular production rate. When laminations are not objectionable, such clays may be worked without the addition of stronger clays by operating under a lower vacuum.

In nine cases out of every ten, it will be found that the higher vacuum produces better results, and 27 inches of vacuum should be provided.

For ordinary use, the time element does not seem to be a factor, provided the clay is properly comminuted, but for a more complete removal of gases a longer time is required than is generally provided for.

It is gratifying to know that machines are now available especially designed for the purpose, incorporating deairing, which are more convenient in setting and more efficient in operation.

Most of the deairing units now on the market do very good work and stand up to it very well. Some are more economical in power used than are others. The worst of the deairing machines render good service while they last, even though wasteful in the use of power.

As a small amount of vapor is drawn out with the air, it is advisable in preparing clay to increase the moisture content about 1%. It is also necessary to protect the vacuum line by using what may be called a "barometric leg," i.e., in connecting the machine to a pump, a pipe is run 40 feet up and down. The moisture will accumulate in the bottom of this pipe.

Increased plasticity, as obtained from deairing, calls for augers of the correct angle of lead to obtain maximum production with minimum loss of power.

Benefits of Deairing

The following are some of the benefits derived from deairing: (1) an increase in strength in the plastic state, (2) fewer rejections at the machine, (3) less loss in handling and in drying, (4) an average of 35% increase in mechanical strength, (5) the complete absence of air voids and visible laminations, (6) lower porosity, (7) a finer all-around appearance resulting in a higher percentage of No. 1 ware, (8) a larger output with but an increase of 10% in power with present dies (with shorter dies, there will be no increase and perhaps a saving in the use of power), and (9) a comparatively smooth surface and corners due to wire cutting.

There is the impression, seemingly justified, that deairing does not produce a better firebrick. I am not ready to accept this as a fact at this time for the reason that the very first deairing unit was for refractory ware, viz., glass-tank blocks. I believe that better comminution and provision for longer exposure in a vacuum will produce satisfactory results.

Deairing of Semidry Press

Experiments made show that there are possibilities of deairing dry-press products, such as firebrick and decorative tile.

Having worked out a deairing application to existing dry presses, I have found that the amount of expense necessary to change them over and adapt them to deairing is so great as to render it prohibitive; a complete press, therefore, is being developed and only waits favorable action from the patent office to invest capital necessary for its production. Some of the features of this press are of interest: (1) it is continuous in operation, (2) it deairs before and during pressing, (3) it presses from both top and bottom, (4) it holds the ware under pressure for a comparatively long period of time, (5) the pressure is under absolute control, and (6) there are few working parts, all of which, with the exception of the dies, are free from exposure to dust. The rams or pressure media are hydraulically operated and self-lubricating. It is the answer to the making of decorative tile and refractory brick by semidry pressing.

If deairing does as much for this branch of the industry as it is already doing in the plastic process, it will be a source of satisfaction to feel that I have contributed something useful to mankind.

"I am very happy to have my name, as well as the Company's name, used in Davis Brown's biographical sketch, and I wish to express the appreciation of the management of Gladding, McBean & Company, as well as my personal appreciation, of your desire to do so.

"Wherever one turns in the clay industry, whether it be in the common brick, refractories, tile, pottery, or fine chinaware branches, Davis Brown's handiwork and the products of his inventive genius may be found. He certainly made a most noteworthy contribution to the progress of the industry and it is my sincere wish that he may have the good health to continue on for an indefinite period in the good work he is doing."

—Ben F. Cake, *Vice-President, Gladding, McBean & Company*

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TECHNICAL PAPERS

CERAMIC GAUGES OF ABRASION-RESISTING COMPOSITIONS*

By Robert Twells

Abstract

Many precision ferrous and nonferrous parts that are being manufactured in large quantities for the Army and Navy must be made to extremely close tolerances. It is necessary in nearly all instances to check each finished dimension with a gauge. Because the tolerance permitted for the wear of the gauge itself is extremely small, the life of the gauge is often short. Ceramic gauges have been developed which are very hard and resistant to abrasion. Gauges made from corundum-base bodies were used in testing steel cartridge cases. The ceramic corundum gauge will measure as high as 350,000 pieces as compared with 15,000 with a steel gauge.

I. Introduction

The war matériel being manufactured in such immense quantities are being made of superior materials and with greater accuracy than ever before. To insure that the measurements do not exceed the required limits, it is often necessary to gauge the critical dimensions of each piece. The abrasiveness of the part being measured, the close tolerances, and the number of inspections required are extremely severe on the gauges used for the measurements. Gauges take the best of material and require the highest grade of toolmaking equipment and skill, all scarce in wartime. If the gauge lasts but a comparatively short time before the wear limit is reached, the result may be serious in time and money.

II. Cartridge-Case Manufacture—Experience with Gauges

The Lamp Division† of The Electric Auto-Lite Company played a leading part in the development of new techniques for the mass production of steel cartridge cases, which previously had always been made from brass.[1] This Division took part in the beginning of the program and their cartridge cases successfully passed the firing tests in October, 1941. Since that time, large quantities of steel cartridge cases of all sizes have been manufactured. The process consisted of six cold-drawing operations starting from a large steel disk. The seventh operation upset the head. The eighth and ninth operations tapered the end. After these operations, each piece was given a visual inspection and a one hundred per cent check of every dimension (see Fig. 1). The large number of dimensions which had to be checked call for many types of gauging equipment. The wear on the gauges was a very serious factor due to the close tolerances required and the abrasive nature of the shells. Steel plug gauges which cost $28 apiece would last only about one day in use. Another type of gauge which cost $300 would last only a few days.

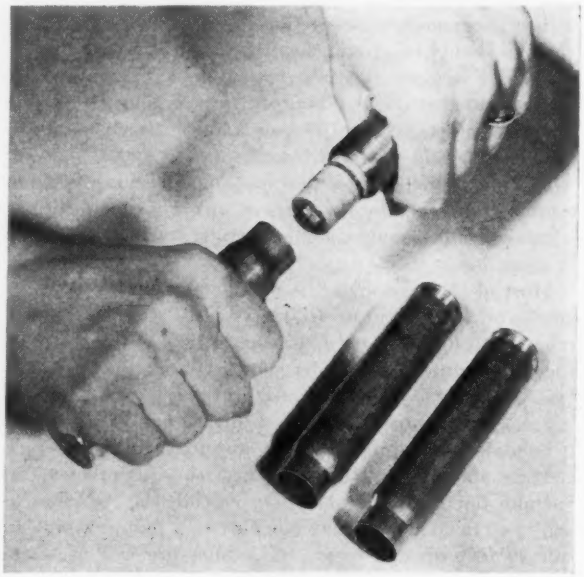

Fig. 1.—Gauging steel cartridge cases with a ceramic plug gauge.

More important than the cost was the difficulty and time required to obtain gauges at any price. Various grades of steel gauges were tried with little improvement. The glass gauges tried about equaled the steel in rate of wear.‡

The Ceramic Department of the Spark Plug Division of The Electric Auto-Lite Company was asked to work on the problem. Plug gauge samples were made from bodies with a corundum base and these were immediately successful (see Fig. 2).

(1) Comparison of Wear

A plug gauge used for measuring the mouth of a 20-mm. steel cartridge case had a limit of 0.0006 inch for wear itself before the gauge had to be discarded. A typical

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 4, 1944 (White Wares Division). Received September 7, 1944.

† The Lamp Division of The Electric Auto-Lite Company is located at Cincinnati, Ohio, and was formerly known as the Corcoran-Brown Lamp Division.

[1] Joseph Geschelin, "Steel Cartridge Cases in Large Quantities," *Automotive & Aviation Inds.*, **89** [8] 22 (1943).

‡ Glass, another ceramic material, has been used successfully to replace steel in gauges (see footnote 2). The results in wear resistance have been reported as equal to or better than steel in some cases. Other advantages are claimed for glass gauges, some of which would apply to other ceramic materials.

steel plug gauge would gauge 15,000 cases for 0.0001 inch of wear. In comparison, the corundum-type ceramic plug gauges would gauge up to 350,000 cases for 0.0001 inch of wear. After 0.0006 inch of wear, the steel gauge could be chrome plated and reground, after which it would wear approximately twice as long as the original steel gauge. It is estimated that the cost of manufacture of a ceramic gauge would not be greater than that of the steel gauge, as much of the cost is in the finishing in either case.

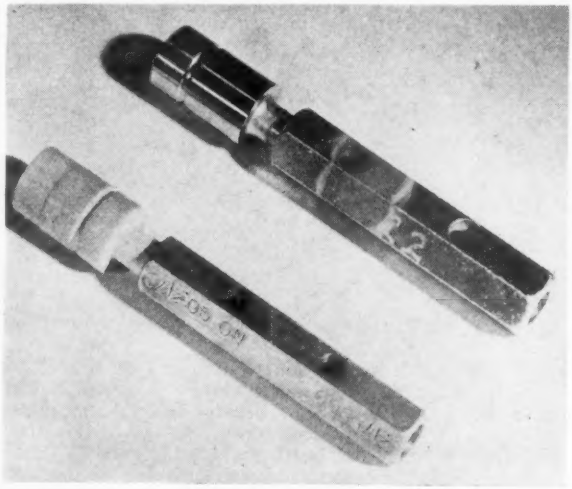

FIG. 2.—A corresponding steel and ceramic plug gauge.

III. General Properties Desirable in Gauges; Some Measures of Value of Ceramic Materials Available

Stone[2] and Oliver[3] have thoroughly covered the properties and types of gauges suitable for manufacture from glass instead of steel. In addition to glass, other ceramic materials and bodies are available. The relative value of the different materials for gauges would be determined by such factors as first cost, cost per inspection pass, and the special properties of each material. Transparency of glass or the lightness of boron carbide are examples of the latter. The relative hardness of the gauge and the piece being tested are important. A soft ceramic material might gauge nonferrous pieces successfully but would be useless for gauging steel. For wear resistance, the ceramic material must have a combination of properties such as hardness and mechanical strength, combined with resistance to impact and abrasion. This combination of properties has been called" Impact Abrasion Hardness."[4]

As a measure of hardness, Table I shows the results for various ceramic materials as determined by the Moh, Ridgway,[5] and Knoop[6] methods. Knoop brings out clearly the outstanding hardness of the diamond and the difference between it and the other materials which lie next to it on Moh's scale. Boron carbide[7] is extremely hard and gauges made from it are extremely good for wear resistance.[8] The position of two corundum bodies fired at cones 18[3] and 31[3] are shown on Knoop's scale for comparison. These bodies are about 85 and 90% corundum crystals, respectively, and are extremely hard and tough. The results obtained with them in gauging have already been discussed.

The position of boron carbide, corundum, and glass on the foregoing scales should indicate the value of other ceramic bodies for gauges if their positions on the same scale are known. Mechanical strength, as indicated by compressive strength, tensile strength, transverse strength, and impact resistance, would have a bearing upon the value of a particular material or body for gauge work. Boron carbide is reported to have a strength in compression of 260,000 pounds per square inch.[7] Corundum bodies will average from 70,000 to 195,000 pounds per square inch, with individual specimens going as high as 263,000 pounds per square inch. Other important properties of ceramic bodies which must be considered are thermal conductivity, coefficient of expansion, modulus of elasticity, and coefficient of friction. Ability to take a high polish is important as affecting the latter.

IV. Method of Manufacture of Gauges from Ceramic Bodies

The tolerances required for gauges call for good workmanship in all materials (see Fig. 3). The methods and

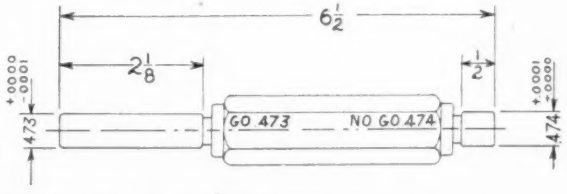

FIG. 3.—Sketch showing dimensions and tolerances required for a ceramic plug gauge.

equipment which have been developed for steel gauges are suitable in some cases for gauges made from ceramic materials. Precision grinding makes it practical to shape ceramic bodies to size after they have been fired, sintered, or fused to final hardness. The development of the diamond grinding wheel, in particular, has made it possible for the ceramic manufacturer to do precision work without being bound by shrinkage variations. The ceramic gauge blank can be made by any conventional method suitable

[2] J. A. Stone, "Glass for Precision Gauges," *Amer. Machinist*, **87** [3] 75–79 (1943); *Ceram. Abs.*, **22** [5] 70 (1943).

[3] F. J. Oliver, "Glass Gauges Sponsored by Ordnance Department," *Iron Age*, **151**, 35–39 (1943).

[4] L. H. Milligan and R. R. Ridgway, "Impact Abrasion Hardness of Molded Boron Carbide and of Some Cemented Tungsten and Tantalum Carbides," *Trans. Electrochem. Soc.*, **68**, 131–37 (1935); *Ceram. Abs.*, **18** [9] 228 (1939).

[5] R. R. Ridgway, A. H. Ballard, and B. L. Bailey, "Hardness Values for Electrochemical Products," *Trans. Electrochem. Soc.*, **63**, 369 (1933).

[6] (*a*) Frederick Knoop, C. G. Peters, and W. B. Emerson, "A Sensitive Pyramidal-Diamond Tool for Indentation Measurements," *Jour. Research Nat. Bur. Standards*, **23** [1] 39–62 (July, 1939); R.P. 1220; *Ceram. Abs.*, **18** [11] 307 (1939).

(*b*) C. G. Peters and Frederick Knoop, "Metals in Thin Layers, Their Microhardness," *Metals & Alloys*, **12** [3] 292–97 (Sept., 1940).

[7] R. R. Ridgway, "Boron Carbide, a New Crystalline Abrasive and Wear-Resisting Product," *Trans. Electrochem. Soc.*, **66**, 117–33 (1934).

[8] "Norbide." Trade booklets published by the Norton Co., Worcester, Mass., 1942 and 1943.

TABLE I

COMPARISON OF HARDNESS

Moh's Scale		Extension of Moh's Scale[5]		Knoop Hardness No. I[6]	
Talc	1				
Gypsum	2			Gypsum	32
Calcite	3			Calcite	135
Brass	3–4				
Fluorite	4			Fluorite	163
Glass	4.5–6.5			Flint glass	180–390
Apatite	5			Apatite	360–430
Steel	5–8.5				
Orthoclase	6	Orthoclase	6	Orthoclase	560
		Vitreous pure silica	7	Fused quartz	475
				Corundum-base body (*a*) fired to cone 18[3]	624–657
Quartz (crystalline)	7	Quartz	8	Quartz	710–790
		Stellite	8		
Garnet	6.5–7	Garnet	9		
Corundum-base bodies (*a* and *b*)	8–			Corundum-base body (*b*) fired to cone 31[3]	780–784
				Chromium plate	850–900
Topaz	8	Topaz	10	Topaz	1250
				Spinel	1250
		Tantalum carbide	11		
		Fused zirconia	11		
		Tungsten carbide	12	Tungsten carbide	1050–1500
Corundum	9				
Fused alumina (impure)	9+	Fused alumina (impure)	12	Fused alumina (impure)	1620–1635
				Fused alumina (white)	1670–1680
Silicon carbide	9–10	Silicon carbide	13	Black silicon carbide	2050–2150
				Green silicon carbide	2130–2140
		Boron carbide	14	Molded boron carbide	2250–2260
				Tungsten, titanium carbide	2600
Diamond	10	Diamond	15	Diamond	6200–6500

to the material or body (see Fig. 4). The fired size has to be somewhat larger than the finished gauge but should be kept to a minimum to avoid excessive grinding; 0.010- to 0.020-inch oversize should be sufficient.

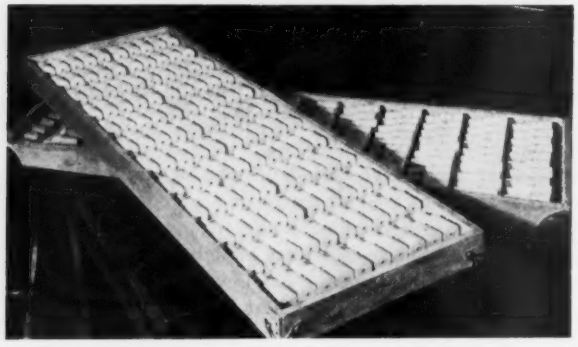

FIG. 4.—Tray of gauge blanks before firing.

Glass gauges are finished with silicon carbide grinding wheels and considerable data are available regarding the grinding procedure.[2,3]

For finishing boron carbide gauges,[8] diamond wheels are essential.

The corundum gauges mentioned (see Fig. 5) have been finished with both silicon carbide and diamond wheels. In each case, male centers are used to hold the blank. The center hole is cut to a 30-degree angle before firing and lapped to smoothness before grinding. In grinding with silicon carbide, a 12- by 36-inch Cincinnati hydraulic grinder is used. The grinding wheel is a 14- by 1- by 5-inch Norton 3780 J. The cutting is done at 5862 surface feet per minute. As much as 0.010 inch can be taken off as a rough cut but this results in too much wear on the wheel; 0.005- to 0.003-inch cuts are preferable. The finishing cuts are 0.0005 to 0.0001 inch. A good toolmaker can grind a gauge in one-half hour.

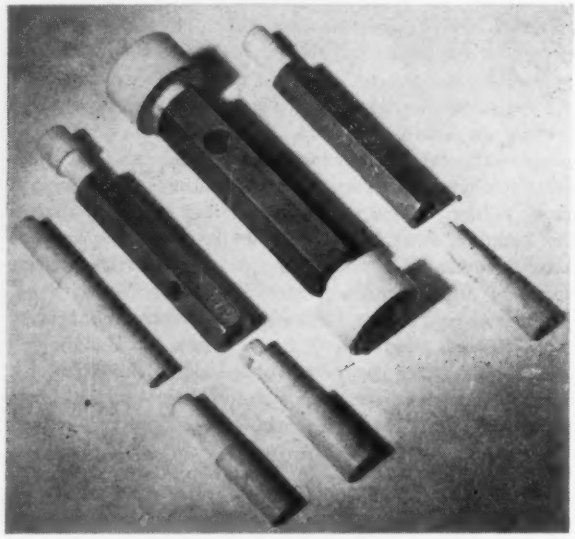

FIG. 5.—Typical ceramic plug gauges with handles.

The gauges made with diamond wheels are ground on a

special machine (see Fig. 6). Norton wheels ME 35588 or ME 36438, 100 S-M-100, 4 by $^5/_{16}$ by 0.503 inches, are used. The wheel is run at 4711 surface feet per minute; 0.0005 to 0.0001 inch is removed per revolution of the gauge blank. Soluble oil is used during grinding. Some types, such as ring gauges, may also require lapping or polishing with rouge, alumina, silicon carbide, or diamond dust.

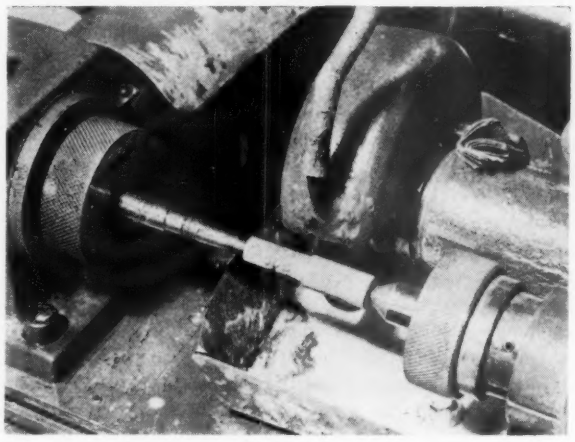

FIG. 6.—Method of grinding a ceramic gauge with a diamond grinding wheel.

V. Conclusion

Ceramic materials of various kinds are a wartime substitute for critical tool steel in gauges. The use of ceramic gauges has indicated that they have special advantages in some applications which should make their use profitable after the war.

THE ELECTRIC AUTO-LITE COMPANY
TOLEDO, OHIO

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DUST REMOVAL AND COLLECTION*

BY R. R. ROBINSON

ABSTRACT

The reasons for dust collecting in plants are (*a*) to protect the health of the workers, (*b*) to protect machinery and equipment, and (*c*) to conserve the dust for its economic value. Methods of dust removal and collection are also discussed.

I. Introduction

From the beginning of the industrial revolution in England, during the latter part of the eighteenth century, the presence of fumes and dust in the atmosphere of mines and manufacturing plants has been a cause of as much unrest among employees as has any other single working condition. This is due to the fact that such foreign bodies as dust particles (and many so-called fumes are clouds of minute dust particles) when entering the respiratory organs are not only eventually dangerous to health, but have an immediate irritating effect.

For more than a century, there has been a determined attempt by humanitarians to interest mining and industry in a movement to create clean atmospheres within working spaces. Within the last decade, that action has taken hold of the minds of employers so that today the question is not whether the air should be cleaned, but how shall it be done. In fact, many problems are not solved simply because the management of a specific industry is unacquainted with the best methods of procedure.

It seems appropriate at this time to give reasons for removing dust from working spaces, methods of eradicating dust and fumes, and the disposition of those foreign substances after they have been removed. Although the subject has been discussed in former meetings of The American Ceramic Society, the discussions have been closely confined to the toxic effects produced by dusts. In the present discussion, no attempt will be made to prove a necessity for dust removal. The dangers to human health are too well known by informed management to require explanation.

Dust may be defined as finely divided particles of or-

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 5, 1944 (Materials and Equipment Division). Received July 13, 1944.

ganic and inorganic solids. Drinker and Hatch[1] have stated:

> If 1 cc. of quartz is crushed into particles 1 cubic micron in size, there will be 10^{12} particles within a total surface area of 6 square meters as compared with 6 sq. cm. for the original block. Assuming a dust concentration of 100 million particles per cubic foot of air, the 1 cc. of material will be dispersed in an air volume of 10,000 cu. ft.

Thus it can be seen that the dispersion of dust particles from manufacturing processes may soon fill an atmosphere to such an extent that visibility may be reduced, and if the dust is dangerous to human life, toxic effects may result, or if the dust is of a carbonaceous nature, violent explosions may result. The following reasons could, therefore, be given for the removal of dust particles from working spaces: (1) the toxic effects of dust on the human body, (2) the effects on visibility in the atmosphere, (3) the explosive effects of carbonaceous dust, (4) the abrasive effects on machinery, (5) the adulteration of products in process of manufacture, and (6) the general cost of cleaning the premises.

The toxic effects of dust are discussed in a bulletin published by the Commonwealth of Pennsylvania Bureau of Industrial Hygiene.[2]

In many factories, even today, visibility is often destroyed, or at least seriously impaired, by dust particles floating in the air. This has been the cause of many accidents. It is hardly necessary to make any further remarks on this phase of the subject.

In the case of dusts of an explosive nature, it has been found advisable and, in fact, necessary to reduce the dust count to the lowest possible minimum. Buildings which house machinery from which carbonaceous dust or other explosive particles are exuded have been equipped with special dust walls and windows which serve as escape valves in the event of explosions. Reference can be made to the numerous bulletins published by the Department of Agriculture of the United States Government covering this subject.

One of the bad effects of dusty atmospheres is that of abrasion of bearings. There are little data to show the amount of damage that is done, but there is no doubt that if the data could have been collected, it would be found that such damage costs industry many times the value of the equipment necessary to clean the air in working spaces.

Another serious danger from dust is that of adulterating products manufactured in the plant. All the manufacturers of whiteware in the ceramic industry are fully aware of the expense that is incurred due to foreign bodies becoming mixed with the clays used in their work. Within a few hours, the dust which permeates the atmosphere of a whole plant could discolor or in other ways affect the quality of the ware so as to increase the number of rejects to such an extent that the loss would be of considerable value.

The cost of cleaning plants due to the presence of dusts is another item of considerable expense. One plant, manufacturing a material from which a very abrasive dust was discharged, did employ, until the outbreak of World War II, a great number of men whose duty it was to clean the automobiles parked on the plant grounds. It is easily seen that in such a plant the cost of cleaning offices and other buildings where cleanliness is necessary would be quite an item of expense.

[1] Philip Drinker and Theodore Hatch, Industrial Dust. McGraw-Hill Book Co., New York, 1936. 316 pp.; *Ceram. Abs.*, **17** [4] 166 (1938).

[2] "Study of Silicosis in the Silica Brick Industry," *Penn. Dept. Health, Bur. Ind. Hyg.*

II. Methods of Removing Dust

To keep the removal of fumes or dust particles at the lowest possible cost, it is always best to arrest the materials and remove them before they get into the general atmosphere of the plant. Whenever possible, hoods should be placed over the machines or at the source of dust. It would be practical and very profitable to align the machinery so that duct systems could be extended in as straight lines as possible or so that separate rooms could be constructed to confine the dusts or fumes and to make possible the removal of these with the least amount of power and machinery. When it is impossible to hood machines, jet velocities of air may be directed toward the source of the dust with collecting hoods placed at a strategic position from which the dust-laden air may be exhausted. In many cases, water sprays may be used or water may be poured over the machines in such a way that the water may mix with the dust and the mixture drained off so that there is no dispersal of the dust particles into the atmosphere.

In almost every case, the removal of dust requires careful engineering. Good engineering may mean the difference between success and failure.

III. Collection

The removal of the dust from a working space is only part of the problem. The management must decide whether this dust shall be discharged into the open air outside the plant, whether it shall be collected, and, if collected, what means shall be taken to dispose of the residue.

If the material is such that it has an economic value which will pay for expensive apparatus, then the dust may be used in process work. In many cases, it may be necessary to grade the dust for particle size. In other cases, the dust may be of little value, but of such a nature that it cannot be discharged into the air without some assurance that it will not be carried over the neighborhood by the winds.

There are many types of dust-collecting equipment which can be used and which are employed for various purposes, depending upon the ultimate disposition of the material. Generally speaking, these collectors may be classified as follows: (1) the mechanical type, which includes those making use of cyclonic air action, (2) those which make use of the principal of elutriation, and (3) those of the filter type.

The filter-type collectors are of many kinds known as the bag collector, the soft material filter collector, and the screen cloth collector. Under nearly all of these machines there is placed a hopper into which material ultimately drops and from which it is taken for final disposal.

Within the last twenty to twenty-five years, there has been a great development in the electrical-precipitation type of collector. The action of these collectors depends upon the fact that dusts can receive and retain an electrical

charge and can be attracted to plates or electrodes when given the proper kind of electrical charge. It is generally conceded that the electrical-precipitation type of collector is much more effective than any other type, but its use has been restricted largely by the cost of investment.

IV. Conclusion

The question of cleaning the atmosphere is becoming one of the most widely discussed questions among manufacturers of the present day. The human being breathes at the rate of approximately 56 pounds of air per day while at rest and many times that amount while at work; it is important, therefore, that the atmosphere which we must use constantly be kept as clean as we can possibly make it.

ROBINSON VENTILATING COMPANY
ZELIENOPLE, PENNSYLVANIA

DISCUSSIONS OF ROBINSON PAPER ON DUST REMOVAL AND COLLECTION

(A) DUST COLLECTION*

BY T. J. BARRY

I. Introduction

The elimination of dust generated in any industrial operation involves, as a general rule, (1) its removal from the point of generation, (2) transportation to the point where it is to be separated from the gases in which it is suspended, (3) its actual separation from the gases, and (4) the disposition of the gases and the collected material.

This is usually taken care of by properly designed hoods located at the point of generation, a duct system, a dust collector, and a fan.

The air and dust must be removed from their source at a velocity sufficiently high to insure control of the dust.

The type of dust separator or collector to use depends on many factors, such as the type of dust, moisture content of the gas, temperature, size of particle, location of the collector, and space available.

II. Classification of Dust Collectors

Dust collectors can be classified generally into settling chambers, cyclones and other inertial apparatus, viscous filters, gas washers, cloth collectors, and electrostatic precipitators.

(1) Settling Chamber

A settling chamber is simply a chamber in which the gas velocity is reduced to a point where the dust will fall out of the gas by gravity. Naturally this will only remove the very coarse particles and has a limited application.

(2) Cyclone Collector

The cyclone type of collector depends upon the centrifugal forces acting on the dust particle to separate it from the gas. In general, the higher the gas velocity and the smaller the radius, the higher the efficiency of the cyclone.

There are many variations in the design of commercial cyclones which materially increase their application in dust-collection work. They are limited, however, as is all equipment. There is a definite field for each type.

A simple cyclone is perfectly satisfactory for separating shavings, sawdust, etc., from a woodworking shop, but it is not worth much on a job where the dust particles are small and the dust is readily "air-borne."

A "high-efficiency" cyclone is well adapted to those jobs where the temperature is a factor, such as fly-ash collection and collectors for driers and kilns.

There are many designs of these collectors which have a definite place in the scheme of things.

The mechanical separator, of the type in which the fan serves the dual purpose as the source of suction or pressure and a cyclone collector, is subject to the same limitations as the cyclone itself and has a bad feature in that all of the dust-laden air goes through the fan. If it is an abrasive material, the fan wheel takes a beating and causes high maintenance.

(3) Viscous Collectors

The viscous type of collector, where the dust-laden gas passes through a labyrinth filter and the dust particles are caught or trapped by the viscous surface, is limited in application and cannot be considered for the collection of industrial dusts.

(4) Wet Collectors

The wet separator or washer has been built for many years and is made in many designs, such as the tower washer, the disintegrator, and scrubbers.

Blast-furnace gas and coke-oven gas are frequently cleaned by this type of equipment. During the past few years, the wet collector has been applied to other fields, such as foundry dust and dust from metal grinding.

Water is usually the fluid used, although it has been found that many dusts cannot be removed by the water alone and other materials must be added to promote the wetting of the dust particles.

The wet systems are limited in application and require attendant equipment, such as pumps and sludge-removal equipment, which add to the operating cost of the system.

(5) Cloth Collectors

Cloth collectors are made in several designs and are the simplest means of separating the dust from the gas. Their field of application is wide and their limitations are quite well known.

Cotton cloth can be used on the gases when the temperature is below 150°F. The life of the cotton decreases rapidly as the temperature goes higher. Wool cloth can be used up to 250°F.; above this temperature asbestos cloth is used.

The bags and screens made of glass have not been too successful.

If the gas temperature goes below the dew point, trouble is likely to develop with cloth arrestors. In many cases, this can be overcome by heating the gas or by insulating the casing of the collector.

The principle of operation of the cloth separator is well known and the factors affecting its design are primarily (1) type of dust, (2) temperature of gases, (3) moisture content of the gases, (4) dust loading, (5) intermittent or continuous use, and (6) method of removal of the dust from the hoppers.

The operation simply consists of having a material in the cloth that will stand the temperature and permit a filter cake of dust to build up on the cloth so that the dust will be filtered out of the air by this combination. A micron particle is $^1/_{25,000}$ of an inch in maximum dimension, so that when we speak of a particle $^1/_{10}$ of a micron in size, it is only $^1/_{250,000}$ inch in its longest dimension.

The filter cake of dust therefore really does the filtering of the small particles, and, as a result, the accumulation of dust must be periodically removed; otherwise the pressure drop through the collector will build up until the flow of air or gas ceases.

The three general type of cloth arrestors are (1) the screen type, where the cloth is held on wooden or metal frames by one of several methods, (2) the envelope type, where the cloth is more or less in the form of an envelope and fits over a frame to hold it in position, and (3) the bag type, where inverted bags are attached to a plate between the dust hoppers and the bag section and are supported from the top, usually by springs attached to the shaking device. In this type, the dust-laden gas enters under the

* Received July 13, 1944.

bag plate, flows through the bags into the baghouse, and the cleaned gas is pulled out by means of a fan.

In the design of a system using this type of equipment, the ratio of air flow to cloth is an important factor and receives a great deal of attention from the designer and should receive a lot more attention from those who install the equipment, as the life of the filtering material and the pressure drop through the collector are vitally affected by this factor. On some types of dust a ratio of 1 cubic foot of air per square foot of cloth must be used. A dust of this type has a flat surface, such as the flaky-type metal dust. With carbon black and similar materials, the ratio should not exceed 2 to 1; with foundry dust and clay dust, 3 to 1. When these figures are exceeded, maintenance is invited.

A continuously operated arrestor is made in two or three sections. It should be made in three sections for best results. Periodically, each section is cut out of the system and the bags are shaken to remove the excess filter cake. This operation is generally taken care of automatically by a timer.

A classifier section or planum chamber is usually built into the cloth arrestor to drop out the heavier material by a reduction of velocity and also to insure uniform distribution of the dust-laden gases to the cloth section.

If the arrestor is used with a grinding or buffing system and there is a possibility of sparks or fire being carried over, a spark arrestor is installed ahead of the bag section.

If the dust is explosive (and many are), the cloth should be positively grounded to eliminate the possibility of a static spark igniting the dust.

(6) Electrostatic Precipitation

Electrostatic precipitators will be discussed later by Mr. Begoon.

III. Conclusion

A dust condition in a plant is a cause of expense. If it is a health hazard it should be eliminated regardless of cost. If it is not a health hazard, it is a nuisance which causes excessive equipment maintenance, rejected products, and dissatisfied workers, and, as a result, a lower quality of workmanship.

The question of whether or not to recirculate the air from a dust collector has caused much discussion. The air should never be recirculated unless it is certain that it does not contain toxic material and that it is entirely free from all harmful dust at all times.

A plant with an adequate supply of fresh air (although it costs more to heat in the winter months) will have fewer lost-time accidents than the plant where the air becomes "dead" after a few hours. The results will more than pay for the extra cost of heating the air.

The writer has tried to keep this discussion as "non-technical" as possible and to refrain from comments as to whose or what type equipment is the best for any particular job.

Dust collecting is a combination of art and science. It involves the proper design of the entire system from the point of dust generation to the final disposal of both the collected material and cleaned gases.

There is more engineering in doing a good job than meets the eye. When one sees so many jobs where the lines are too big and fill up with dust or are too small and do not get enough of the dust away from the source and the equipment inadequate or of the wrong type, it makes one wonder just how to paint the picture so that it can be seen that a properly designed system will pay dividends even though it seems to be "just a dead operating cost."

PARK BUILDING
PITTSBURGH, PENNSYLVANIA

(B) ELECTRIC AIR CLEANING*

BY G. F. BEGOON

I. Introduction

Electrostatic air cleaning as applied in ventilating systems is a new and revolutionary electronic development. Why is there any need for air cleaning, let alone electric air cleaning?

We have falling upon our cities today, at the amazing rate of 1950 tons per square mile per month in Pittsburgh, 1530 tons in Chicago, 1450 tons in Baltimore, and comparable figures in other cities, dirt particles which have become the source of great economic waste and maintenance expense. Within our homes and places of business they blacken and damage paint, wallpaper, drapes, and decorations, soil fabrics, cause excessive maintenance of industrial machinery, etc.

The size of these particles is measured by a minute metric unit known as the micron. A micron is equal to one thousandth of a millimeter, or $^1/_{25,000}$ of an inch.

Generally speaking, the miscellaneous dusts, pollen, and other particles larger than 1 micron tend to settle from the air unless it is in motion. Inasmuch as we are interested in air in motion, we are concerned with the particles it carries. These range from heavy industrial dusts of 8000 microns down to tobacco-smoke particles as small as $^1/_{10}$ micron. This is pretty small, when it is considered that a 10-micron particle is about the smallest that can be seen with the naked eye.

Until recently, no practical method had been devised to really clean the air of the very small particles. Although mechanical filters are effective in removing the larger dirt particles, i.e., from about 5 microns up, they are practically useless in attempts to catch the very fine particles whioh comprise 80 to 90% of the total and are less than 1 micron in diameter.

* Received June 22, 1944.

II. Electrostatic Precipitation

The only effective method known today for removing these very fine particles from an air stream is electrostatic dust precipitation, the principles of which have been known for many years and applied successfully in such applications as boiler stacks, smelters, and cement mills, and are known as Cottrell precipitators. The high voltage used in the Cottrell system (from 30,000 to 100,000 volts) causes such a high generation of ozone, however, that the air thus treated is not safe for breathing purposes and hence not suitable for ventilating systems.

This is the problem that was solved by scientific research in perfecting the electric air cleaner that operates at voltages which generate so little ozone that its concentration is in the order of that found out of doors on a bright sunny day.

The voltages used are 13,000 for ionization and 6000 for collection. These are obtained by means of a rectifier or power pack. The house voltage of 115 volts, 60-cycle, single-phase, is stepped up to about 6000 and rectified to direct current by two electronic tubes. By means of a modified voltage doubling circuit the proper ionizer and collector plate voltages are obtained.

By 1937, the electric air cleaner had reached the point of practical use, and a few installations were made as the air-cleaning component of air-conditioning or ventilating systems in offices, stores, banks, and other commercial buildings. These installations were made to obtain relief from annoying and costly air-borne dirt, dust, soot, and smoke which soil and damage merchandise in stores and shops and cause frequent redecoration and excessive cleaning expense.

In subsequent years, further installations were made in similar establishments and many other types of businesses, such as cleaning the air in pharmaceutical and chemical plants where the slightest microscopic specks cause imperfections in products and processes.

The electric air cleaner is used to clean the ventilating air for large rotating electrical machinery in steelmills, power plants, and substations. Failures of these machines

are often caused by excessive temperature rise or leakage over the insulation due to dirt on the windings.

In telephone exchanges, electric air cleaning is used to help maintain delicate relays by removing the microscopic dust particles which cause faulty operation and noise in the circuits.

In textile mills, electric air cleaning has been applied to eliminate soot, smoke, dirt, and dust during winding, spinning, weaving, and drying operations. These microscopic particles damage the yarn and fabric to such an extent that about 15% of the total production has to be sold as inferior products. Mills equipped with the electric air cleaner have reduced this to about 6%.

Other establishments, such as hospitals, restaurants night clubs, radio stations, libraries, and laboratories have found that investments in electric air cleaning pay big dividends.

When the war came along, many of our materials were placed on the critical list and purchases were subject to priority control, which brought to an end the peacetime business. On the other hand, the necessity for clean air in many wartime production problems opened the door to new markets.

As its contribution to wartime production, electric air cleaning is being applied where precision engine parts, instruments, lenses, and optical goods are manufactured, inspected, and assembled. Tiny unseen abrasive and corrosive particles that damage superfinished surfaces cannot be removed by mechanical filters, yet the electric air cleaner takes them out of the air and saves many costly rejects.

Electric air cleaning is applied to catch the oil mist and smoke generated from coolants on machine tools. This oil mist has become serious enough in some plants to (1) cause a fire hazard, (2) condense and drip from overhead beams, lighting fixtures, and pipes, and (3) lead to premature electrical insulation failures and make the working environment unpleasant. Precipitating the oil mist at its source not only eliminates these objections, but also recovers the cooling oil for reuse. Also some operators are now able to use a better grade of coolant oil, which results in better work and increased production.

Another use is the control of welding fumes and smokes. All the applications mentioned have been very successful.

The total installed electric air-cleaning capacity at the present time is about 50,000,000 cubic feet per minute, 75% of which is associated with air-conditioning systems. Even so, the surface has barely been scratched. These installations require only 15 watts of electric power per 1000 c.f.m. of cleaning capacity.

III. New Developments

In addition to the electric air cleaner as we have known it in the past, there are some new developments in the offing that should substantially increase the potentialities of this device.

Right now, work is being done on a combination cyclone dust collector and special-design electric air cleaner for boiler-stack smoke and fly-ash control. No official announcement has yet been made in this regard because it is only recently that WPB gave one of the power companies the necessary priority to continue the work. The results so far, however, look quite encouraging.

Another new development involves the home market. We are now making definite plans to provide electric air cleaning for home use, particularly in homes with forced-air heat. We have already built about 100 so-called home central units, the majority of which are now installed as pilot installations in homes around Pittsburgh. The results obtained, from the standpoint of keeping the house clean and contributing to the health of the family, particularly those suffering with hay fever, have been excellent.

We hope to provide a complete cabinet unit for homes which can be installed at a cost to the user of about $250. Market research indicates that, if this can be realized, there will be a strong demand to be satisfied for this type of unit for existing homes equipped with forced-air heat. The housewife will see to that.

For new construction, in addition to the self-contained unit just mentioned, we are working with the furnace builders to help them incorporate the cells as an integral part of the furnace. This will enable the home to have the advantages of electric air cleaning at much less cost.

Ceramic plants in which contamination of the ware is a serious factor may, in the near future, be using the electrical method of cleaning air, not only to prevent foreign materials in dust particles from spoiling work in process, but also to clean the atmosphere of workrooms without being obliged to heat great quantities of new outside air.

PRECIPITRON DEPARTMENT
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RAW MATERIALS FOR PORCELAIN ENAMELS SURVEY OF CURRENT MARKETS AND ALLOCATIONS*

BY JOHN W. ILIFF

ABSTRACT

Although many raw materials for porcelain enamel have been restricted, either by market shortages or by WPB regulations, all important raw materials except tin oxide are currently available in at least moderate quantity. A group of materials warranting individual attention is considered.

I. Introduction

Conversion, steel, and man power have all put limitations on porcelain enameling to a far greater degree than shortages of enamel raw materials. Indeed, the relatively light demand for chemicals and minerals has been met with little trouble and with little need for the use of unsatisfactory substitutes. Nevertheless, it is prudent to keep a close watch over material requirements, especially on materials under allocation.

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II. Availability of Raw Materials

(1) Mill Additions

Tin oxide may not be used (WPB Order M-43), but the zirconium opacifiers and Uverite can be used. Uverite has been available continuously in quantity adequate for consumption. So have the zirconium opacifiers, although in some cases it has been necessary to change types.

(2) Color Oxides

Both cobalt and cobalt-free blacks contain substantial amounts of chrome, which is restricted and in very short supply. Cadmium colors, comprising the bright reds,

oranges, and yellows, are no longer on allocation, but are hard to obtain because the color manufacturer is limited by restrictions on his cadmium raw materials. Cobalt blues, antimony yellows, greens, and most browns are freely available.

(3) Electrolytes

The supplier must list orders for sodium aluminate with WPB. Nickel salts are closely controlled by WPB. Orders should be placed with the supplier a month ahead and should state full descriptive end use, contract, and preference rating.

(4) Smelt Chemicals

Antimony oxide was taken completely off allocation and is freely available. Antimony was tight, because there were heavy requirements for flameproofing, but it has been available continuously to the enameler, either in the form of the oxide or as sodium antimonate. Cobalt oxide is also completely off allocation and is readily purchased.

(5) The Fluorides

Cryolite, sodium silicofluoride, and fluorspar, although by no means easy, offer no serious concern on the basis of current demand.

(6) Titanium Oxide and Rutile

Titanium oxide and rutile are scarce and may offer a real problem, as they are important for acid-resisting enamels. Preference ratings lower than A–2 have no effect on orders for titanium dioxide, unless for military orders.

(7) Zinc Oxide

Zinc oxide is on allocation, but has a small order exemption of 4000 pounds per month.

(8) Sodium Nitrate

Sodium nitrate is regulated by WPB by approval of a supplier's order list. It is being released regularly for the manufacture of frit and may be supplied further in quantities up to 5000 pounds per month without specific approval.

III. Conclusion

General priorities regulation No. 1 affects all materials under priority control. Essentially this order makes mandatory that all purchase and handle strategic materials to assure an adequate supply for war industries and a fair distribution to all. One of the requirements of this order is that inventories be kept down to a minimum working level. In the enamel industry, there has been little temptation to do otherwise, with the demands so uncertain, and most ordering has been strictly against requirements. With the possibility of an expanding market, however, there is normally a tendency to order for future reserves. On strategic materials, this procedure not only would make more difficult the problem of meeting an expanding demand, but is also directly contrary to law.

HARSHAW CHEMICAL COMPANY
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FILTER-PRESS SACKS, FABRICATION AND SUGGESTIONS FOR THEIR USE*

BY F. A. KOCH

ABSTRACT

Economical sliphouse operation depends on the filter-press sack. The weight of the cloth and type of construction, treatment, and method of sewing the center are considered in relation to the pump pressure and type of body filtered. Synthetic filter fabrics have possibilities for future use, but they are too expensive at the present time. Press plates should be cleaned and painted regularly. Sacks should fit properly to avoid losses through rim cuts and creasing and should be washed frequently as a factor in lengthening life and for efficient press operation.

I. Introduction

Filter-press cloths and sacks represent the largest factor in economical sliphouse operation. Their performance depends greatly on the construction and weight of the fabric used in making them.

II. Fabrics Used

Pottery duck, the most satisfactory fabric, is a nearly balanced weave with 54 threads of 2-ply yarn in the warp and 40 threads of 3-ply yarn in the filling (per square inch, on the basis of 10.54 oz. per lineal yard, 30 inches wide). This particular construction gives a tightly woven fabric with few pinholes.

Regulation army duck has been quite popular, but it is neither as strong as pottery duck nor as closely woven. There are 46 threads of 3-ply yarn in the warp and 36 threads of 2-ply yarn in the filling. This comparison indicates that the smaller number of filler threads, of only 2-ply yarn, cannot possibly give the strength found in pottery duck.

Single-filling duck has 88 threads of 3-ply yarn in the warp and 31 threads of only single-ply yarn in the filling. This obviously produces a fabric with great warp strength but one subject to possible failure owing to the single-ply filler threads.

Filter and chain cloths are also balanced-weave fabrics, but the openness of their construction makes them unsatisfactory.

Some synthetic fabrics are now available, e.g., the vinyl fabrics which are copolymers of vinyl chloride and vinyl acetate. Although these fabrics have no shrinkage and require no treating because the yarn will not support bacterial or fungus growth, the extremely high cost makes their use uneconomical. They will cost three or four times more

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than a cotton fabric and, because they are subject to rim cuts and wedge holes (as any filter sack), frequently must be discarded before the original high first cost has been realized through added service.

III. Treatment of Filter Cloths

Creosote oils are used as an antibacterial treatment, but their corrosive action on the hands and arms of the workers makes them unpopular. Sacks so treated also tend to become increasingly stiff the longer they are used. Tannic acid has been used, but the protection against the action of mildew and wet rot is short-lived, as the solution is not fixed in the cloth. The cuproammonium and cuproammonium silver nitrate treatments are the most popular. The cuproammonium treatment consists of a copper hydroxide solution, a combination of aqua ammonia and pure copper metal. In time, this treatment is partially washed from the cloth.

To increase the effectiveness and permanence of this treatment, a silver nitrate bath is used. The resultant cloth, although slightly higher in price, seems to justify the added cost. This finish is black, which distinguishes it from the green cuproammonium finish. In each of these treatments, the fabric is denapped in the metallizing process. The removal of the fuzz or nap of the duck eliminates the tendency of the clay cake to adhere to the cloth. It also speeds up the production cycle of the press, in that removal of the clay cakes from the press requires less effort and is accomplished faster than when untreated sacks are used.

IV. Weight of Cloth to Be Used

The weight of cloth depends on the type of body to be filtered and the pump pressure to be used. A high feldspar, high ball-clay body may require heavier cloth, whereas a semivitreous or open body can be filtered successfully with a 10- or 11-oz. cloth. When pump pressures are above 100 lb., heavier cloth generally gives better service; 11-oz. cloths are satisfactory on pressures below 100 lb. Filter sacks made from 11-oz. cloth and used at 140-lb. pressure have outlasted, however, in some instances, 13-oz. sacks at 85 lb.

V. Construction of Filter Sacks

The majority of filter sacks are made in essentially the same manner. Most manufacturers offer center-hole constructions with or without a patch, with a turned center or sewed with a buttonhole stitch. The best type of construction is a matter of personal preference from operating experience. The buttonhole-stitch center is quite durable but in some cases allows leakage at the center hole. The turned center, however, will seldom leak but does tend to break or tear at the circumference of the circle.

Generally linen or cotton thread is used. The difference in cost between the cheapest and most expensive thread is so small, however, that economies in the thread used are unnecessary.

VI. Fit of Sack Important

The most important factor that definitely controls the life of a sack is its fit. No sack is better than its fit. If it is too tight, the pulling and stretching in attempting to make it fit may tear the sack at the center-hole sewing and will form wrinkles and folds which will be cut by the rim of the plate in closing. If the sack is too large, the cloth will wrinkle and bunch at the edges.

Excess shrinkage may cause a misfit, owing to a variable in the looming of the cloth or, if a treated cloth, to the failure of the processor to shrink the fabric to its fullest extent.

VII. Needed Care of Sacks

Under no circumstances should wet and dirty sacks not in use be left for an extended time on a press. They should be removed from the press, washed, and hung up to dry thoroughly in a room of even temperature with air circulation between the layers of cloth.

Sacks may be washed in a tub or drum washer, and, in some cases, ordinary home washing machines may be used. The wash water should be tepid, and it helps to use a small quantity of neutral oil soap in the wash water. Mold soap is excellent for this purpose.

Cloth processors, who apply various preservatives and treatments to the cloth, generally discourage the washing of filter sacks. They recommend that the occluded clay be freed by a stiff stream of water from, for example, a hose. Some mechanical agitation, however, should be used to loosen and free the deeply imbedded particles of clay. Although this may remove some of the treatment, it does clean the sack and allow faster filtration.

Some potters clean their sacks by steaming on the press. The advantages of this method are debatable. For every potter who sees an advantage, there is another who claims he has discontinued the practice because, although it cleaned the sack, it shortened its life.

VIII. Conditioning of Press-Plate Face

Little attention is given to the conditioning of the face of the press plates. When their condition warrants, they should be wire-brushed or, if badly rusted, sand-blasted; they then should be painted. Red lead or water-repellent synthetic enamels are excellent for this purpose. In normal times, it might be possible to zinc- or cadmium-plate the leaves at a nominal cost.

IX. Use of Liners

Liners made from old, torn, or blown sacks can be used to lengthen the life of filter sacks. The center-hole sewing should be cut out, thus increasing the center-hole diameter one inch. The liners are then placed against the plate face and the regular sack is put on.

X. Patching of Sacks

Patching of sacks is resorted to generally, but it is questionable whether this practice is advisable beyond certain limits. Some potters claim that each patch placed on a sack costs 5¢ and that no one should spend more than 15¢ per sack, or apply more than three patches. The life expectancy of the sack justifies no added investment.

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POSTWAR FIRING EQUIPMENT AND METHODS*

By George D. Brush

I. Introduction

The field of ceramics has one process in common. All ceramic ware must go through a firing process. In most cases, the firing process is the final operation. It is important, therefore, that the ware be properly fired to produce a salable product.

There are three general sources of energy for the firing of ceramic ware, viz., natural gas, fuel oil, and coal. To control this energy so that the temperatures required will not be too high or too low, methods have been devised to do this mechanically.

II. Firing with Gas

Artificial gas is too costly for heavy clayware and is seldom used. Natural gas, however, is plentiful in many localities and is used for all types of ware. There are three general methods of burning natural gas. The first method is to force gas through the burner under pressure and to inspirate combustion air. The second method is to force combustion air through the burner under pressure and inspirate the gas. The third method is to mix both gas and air under pressure.

The first method of burning gas under pressure and inspirated air is commonly used in periodic kilns and to a certain extent in tunnel kilns. To control this method of firing, a regulating valve is placed in the main gas line and the pressure is raised or lowered to control the temperature in the kiln.

The second method of forcing combustion air through the burner and inspirating the gas is commonly used in tunnel-kiln operation. The air pressure ranges from 10 to 20 ounces and the gas is reduced to zero so that the gas used is always proportional to the amount of air used.

The air pressure alone is controlled by a regulating valve. A high and low control is common. The control valve is set to open and close at a fixed point. The spread between high and low is made sufficiently wide to take care of temperature fluctuations in the kiln. Another control value is now being used which operates over the full range of the valve opening and is known as a full throttling valve. As temperatures in the kiln increase over a fixed position, the full throttling valve starts to close and will continue to close until the temperature rise has been stopped and started in the opposite direction. When the temperature drops below a fixed position, the valve starts to open and will continue to open until the temperature again starts to rise.

The third method is to use both the gas and combustion air under pressure. These are combined in a mixer to the correct proportions. The proportioning valve is made in such a way that the gas and air are kept in the same proportion from full open to full closed.

The control valves generally are operated by an operating motor.

III. Firing with Oil

Fuel oil is widely used in all parts of the world. It is easily transported, has a high fuel value, and is adapted for high-temperature firing. Three methods of control are generally used.

One method is to control the oil pressure and leave the air pressure constant. A control valve is placed in the oil line to vary the pressure. Under increased pressure, more oil is forced through the burners and raises the temperature in the kiln. Under decreased pressure, less oil is forced through the burners and drops the temperature in the kiln. This method is adapted only when excess air in the kiln does not harm the ware.

The second method is to use a controlling valve in the air line and a regulating valve in the oil line controlled by the pressure in the air line. Simply by regulating the air the oil pressure is automatically controlled.

The third method is to use proportioning valves on the air and oil lines, linked together so that an increase or decrease in air also gives an increase or decrease in the oil. By proper linkage a group of burners can be regulated by one controller.

IV. Firing with Coal

Coal has been the most widely used fuel in firing kilns. By rule-of-thumb methods, a firing procedure was developed on periodic kilns, which gave good results. With more rigid requirements of quality and size of ware it is now necessary to use some means to control coal firing more accurately. This is especially true in tunnel-kiln firing.

The most practical method for all types of ware is to use stokers. Much development is now going on to insure an economical stoker that will stand up under the heavy usage required in ceramic plants.

The best method to regulate stoker firing is to control each stoker separately, although a group of stokers can be regulated by one controller. The air and coal feeds can be adjusted for each stoker.

Powdered coal has been used in firing heavy clayware and is controlled by regulating the feed on the powdered coal.

Coal is also used to make producer gas. The producer gas is controlled in the same manner as any gaseous fuel.

V. Temperature Controller

The heart of the regulating system on all fuels is the controller, which is generally a potentiometer type. A thermocouple is located in the kiln at the location to be controlled. The proper temperature is determined and the fixed pointer is set on the scale of the controller at the determined temperature. When the temperature in the kiln is below the fixed temperature desired, the controller opens the control valve. When the temperature in the kiln is higher than the fixed temperature, the control valve is closed. On stoker coal firing, the controller starts and stops the stoker as the temperature is below or above the fixed temperature.

When full throttling control valves are used, a second

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controller is used with the primary controller. This second controller is the instrument that gradually opens or closes the full throttling control valve. It also corrects droop caused by a variation of loading in the tunnel kiln.

Another set of control instruments is now being developed to operate on air pressure. These instruments have many desirable features for ceramic firing. When used with air pressure-operated control valves, full throttling control can be obtained in a simple manner.

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ANTIQUE GLASS OF ENGLAND AND IRELAND*

BY DOUGLAS CARSON

Beginning of English Glass Industry

Jacob Verzelini

With the exception of some early Roman pieces of glass which have been excavated in parts of England, little interest had been taken in this product until the arrival in England of a Venetian glassworker, Jacob Verzelini, in 1571. He was brought over from Antwerp in Belgium by John Carré, who owned the Crossedfriars Glasshouse in London, presumably to manage this glasshouse for Carré. Carré died in 1572, however, and Verzelini was left in sole charge but without any official notification as to his position. He carried on the work at the Crossedfriar's until 1575, when the glasshouse was set on fire and burned to the ground. This was, in all probability, an act of sabotage, as the English people resented foreigners operating in any large capacity in their own country. And in this particular case, it was not only Verzelini but all of the glassmakers who were Italian.

Verzelini acted with decision and promptitude. Two weeks after the fire, he sought protection from any further trouble by applying for a royal privilege, and in December of the same year he received his famous monopoly, which allowed him the sole English right to make "Venetian glasses" for a period of twenty-one years. At the same time, he took out naturalization papers and became a British subject in November, 1576.

For the next thirty years, glassmaking was carried on exclusively by Italians who had been imported into England, and the Venetian influence predominated. When Jacob Verzelini died in 1606, he knew that he had successfully started the glass industry in England.

Use of Coal

Robert Mansell

The seventeenth century was a period of successive glass monopolies, one of the largest being operated by Sir Robert Mansell, who had been an officer in the British Navy. He retired from the Navy to devote his entire time to the production of glass. Through him, glassmaking in England and Scotland became universal. It was at the start of his monopoly in 1623 that the firing of glass furnaces with coal was tried, and it was largely due to this innovation that coal mining developed generally throughout the country. Soon glasshouses sprang up in different parts of England where coal was to be found, and their operation continued fairly successfully until 1649 when the Commonwealth began. Under Cromwell, the glass industry, being fairly young, lapsed owing to rebellious conditions and did not achieve importance until the Restoration in 1660, when Charles II ascended to the throne.

FIG. 1.—RAVENSCROFT GOBLET. Bowl decorated with nipt diamond waies; hollow stem with raspberry prunts; seal in lower part of center of raven's head; molded foot with folded edge; $7^{2}/_{8}$ inches high. Made by George Ravenscroft. England circa 1677.

* Address given at the General Luncheon, Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 5, 1944. Received April 5, 1944.

Lead Glass Innovation

George Ravenscroft

Even at this time the Venetian influence remained very strong in glass design. Nor was it to change much until George Ravenscroft perfected his formula for lead glass in 1676, permitting a new treatment because of the heavier metal. He began his experiments in 1673 when he received a patent from Charles II for making "a kind of crystalline glass." It is interesting to note the terminology in the patent, which indicates that they were not quite sure of the results. During the first year, Ravenscroft worked at his Savoy glasshouse in London. Being a technical man himself, he relied on the blowing talents of his factory manager, Hawley Bishop, who, incidentally, succeeded Ravenscroft after the latter's death in 1681.

In 1674, Ravenscroft started a small glasshouse at Henley-on-Thames outside London, and here he continued his experimentation and improved his formula. During this period, he ran into many difficulties, the greatest being an excessive cloudiness and flaking, known as "crisseling," which appeared on the surface of the glass. Two years later, Ravenscroft overcame this and other difficulties, and, in 1676, he was ready to market a new glass.

FIG. 2.—RARE AMEN WINEGLASS. Bowl decorated in diamond-point engraving with crown, royal cipher, and three verses on bowl and one on foot; specimens with four verses extremely rare; now in Metropolitan Museum of Art collection, New York, N. Y. England circa 1745.

FIG. 3.—RARE PAIR OF BRISTOL OPAQUE WHITE GLASS CANDLESTICKS. Decorated in colored enamel with flowers and butterflies by Michael Edkins; bobeché Battersea enamel decorated to match candlestick. Bristol circa 1765.

In the meantime, he had made arrangements with the Glass Sellers' Company of London for the exclusive distribution of his glass to London dealers. The Company handled some of his experimental pieces, but it was not until the formula was perfected that they granted him the right to seal his work with the raven's head, taken from his own coat of arms. Advertisements appeared in the London newspapers of 1677, stating that if any glass, bearing the seal of the raven's head, should show signs of crisseling or decay, it could be returned to the seller for exchange or the purchaser's money would be refunded. Sealed Ravenscroft specimens are extremely rare today and of the numerous pieces of various types of designs that must have been made both at the Savoy in London and his glasshouse in Henley-on-Thames, only seven sealed pieces are in existence today. Six of these are still in England, four being in British museums, and two others are in a private collection and slated for a British museum. The seventh piece was bought by Steuben from the famous collection of the late Colonel Ratcliffe. It was purchased at Christies' in London in June, 1943. This goblet, brought to America on the Clipper and now on exhibition in the New York Steuben shop, is the only sealed Ravenscroft specimen in America and the only one likely to come here in predictable time. In all probability, had it not been for the war, this specimen never would have left England.

At the end of Ravenscroft's patent in 1681, which also marks the year of his death, news of this new type of glass had spread through the Provinces and was soon being made throughout England. The invention of lead glass revolutionized glassmaking and from it a true English

glass developed. It brought about designs which were typically English and suited to the heavier metal.

Until 1700, lead glass was made from calcined flint, as sand of pure-enough quality had not yet been discovered in England. About 1700, clean sand was discovered in several places, and the use of flint was dropped. But, as it had become known as "flint glass," the name stuck to it for the next hundred years or so.

This heavier lead metal gave the glass brilliant refractive qualities, but the first specimens were left perfectly plain, except a few which were decorated with diamond-point engraving.

FIG. 4.—BUCKET BOWL GOBLET. Opaque white twist stem and plain circular foot; bowl decorated in brilliant heraldic colors with full coat of arms of Richard Lowndes; shield outlined with Chippendale rococo scrolls; on reverse, large head crest in gilt; gilt rim; $8^1/_2$ inches high. England circa 1765.

(1944)

It was not until 1725 that cutting was started and came into vogue as a decoration, developing different forms of design through the eighteenth century. As diamonds are cut to enhance the natural beauty of the stone, so cutting was employed to bring out the brilliance of glass by utilizing its refractive qualities.

Another form of decoration was the copper wheel engraving, which in many of the earlier specimens was done by artists or engravers from the Low Countries who had come to England to carry on their trade. By this time, English glass was so superior that in many cases it was even sent abroad to be engraved.

Enameling of Glass

Glass was also enameled in brilliant colors, mostly by Continental artists. Decoration of this type was never popular in England; consequently, few pieces were made. The specimens extant are of an entirely different and much finer technique than those of Continental origin. The finest specimens of English enameling on glass were done around the middle of the eighteenth century. The best pieces of this type were executed by a man named William Beilby of Newcastle, whose sister, Mary, helped him in his work. He enameled principally coats of arms in heraldic colors on goblets and wineglasses, most of his pieces being executed from 1763 on.

As heraldry is a complete study in itself and must be absolutely correct in all details, Beilby was able, through his brother, who was a heraldic engraver of silver, to obtain all of the proper information.

Steuben recently received from England one of these rare and fine specimens, the only one in America, except the equally important one in the Lorimer Collection in the Philadelphia Museum of Fine Arts. The goblet in Steuben's possession has the full coat of arms of Richard Lowndes and was painted about 1765.

Another outstanding artist of the period was Michael Edkins of Bristol who decorated many of the finest specimens of opaque Bristol white glass with flowers, scenes, and insects, similar to the decorations carried out on fine porcelain of the early period. Good examples of this early white glass are very rare today.

Excise Tax Retarded Lead Glass

An extremely heavy excise tax was put on glass by weight in 1745. This meant that the pieces had to be made much lighter and thinner to avoid paying this tax; a period followed, therefore, when most of the glass was absolutely plain and had a low lead content, which gave it a rather oily appearance. This plain period continued for many years. During this time, however, there was a certain amount of decorated and cut glass made for the wealthier families of England where price was no object. In 1777, still heavier taxes were imposed upon the glassmaker, which helped to retard the advancement of cut-glass design.

English Glassmakers Move to Ireland

In 1779, Ireland, who up to this time had not produced much glass, was granted free trade. It was then that the English glassmakers, so heavily burdened with taxes in their own country, flocked to Ireland where they could produce glass in any quantity, of any weight and cut, and

free of tax. Thus, with open markets for export, these Irish glasshouses, founded by Englishmen, prospered exceedingly. So, oddly enough, Irish glass was actually made by Englishmen, using English designs and imported English materials.

FIG. 5.—IRISH WINE URN AND COVER. Decorated with band of leaf cutting and broad and fine flutes; circular-domed base with decoration with flat cutting; tap also entirely of glass; 26½ inches high. Ireland circa 1780.

Waterford Works

In 1783, Penrose Brothers of Waterford in southern Ireland started a factory there and imported John Hill from Stourbridge, England, who brought sixty of his best workmen with him, and together they operated the Waterford factory. The same thing was true of Edwards of Belfast, another famous glasshouse. Benjamin Edwards, the founder, was a workman from Bristol, England. It was also true of the factory of Cork, where the Glass House Company imported English workmen and materials at great expense.

The common and widespread habit of calling all Irish glass "Waterford" is erroneous. At this particular period, there were glass factories operating in Cork, Waterford, Newry, Dublin, and Belfast, as well as many less important ones. It is impossible to state definitely from which factory a piece came unless the name is marked on the piece. Few are so marked.

It is a fallacy that Waterford glass can be told by its bluish tinge. This has been definitely refuted by all the authorities on glass. Color, owing to impurities, was purely accidental, and it might have been found in glass of any factory operating at that period and in no way marks it as Waterford or any one specific Irish glasshouse.

It is supposed that Ireland during the period from 1780 to 1825 produced about two-thirds of the glass made in the British Isles, and a few of the Irish factories operated until near the end of the nineteenth century. The factory at Waterford closed finally in 1853. About 1825, Ireland lost her free trade and many of the Irish factories closed. Glass manufacturing returned to England with a rush. By now, however, the Victorian era was beginning, and its ornate and heavily cut design is of little interest to the collector of today.

Steuben Antique Glass Collected by Cecil Davis

Starting its collection in 1941, Steuben was fortunate to procure the assistance of Cecil Davis of London, one of the outstanding antique glass authorities in England today. He is consulted by museums and collectors, and his opinion is valued most highly by them. During the last two years, Mr. Davis has sent Steuben numerous shipments which have included many of the rarest and finest specimens of glass of the period from 1680 to 1820 that can be found today. It is logical to ask, "Where does Mr. Davis find all of these unusual pieces?" In the first place, antiques are much like currency. They keep circulating from one owner to another. There are estates where large collections of personal possessions gathered through many generations eventually came to light and have been disposed of at auction. Also, small dealers throughout the country keep Mr. Davis informed of any important pieces that may come to light in the vicinity. Then, of course, there are always people who are trying to raise money from their belongings; if it happens to be antique glass, a well-known dealer like Mr. Davis is the logical person to try to dispose of it.

The Steuben collection is displayed in a specially designed room on the mezzanine floor of the New York shop. It forms an interesting complement to the modern Steuben glass for which the shop has become famous. It is to the

old what Steuben is to the new, the forerunner of present-day glass technique. Of course, Steuben has benefited by past experience and modern science in the perfection of its metal, which accounts for its brilliance and clarity, a purity undreamed of in the days of George Ravenscroft. But the same hand methods of blowing and shaping prevail, for it is Steuben's aim to perpetuate the ancient art of glassblowing; to apply skilled craftsmanship to sound design and exceptional metal. In this country, with its mass production and machine precision, too little reliance is placed upon hand-fashioned products and the individuality obtained thereby. Steuben has sought to fill this void in the field of glass.

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LEGAL PROTECTION FOR ARTISTIC DESIGNS*

BY ERASTUS S. ALLEN

ABSTRACT

Two types of protection for artistic designs are by copyright and by patent. Recent administrative interpretation suggests that the only permissible protection for a design for an article having a utilitarian purpose is by design patent. What is an article having a utilitarian purpose? This question is discussed, and an explanation is given of what a design patent is and what protection it affords. Reference is made to what the courts have said about new and original ornamental designs for articles of manufacture, particularly as to when they exhibit invention. A common-sense way to view the situation is given.

I. Introduction

All law on the subject of patents and copyrights springs from the power delegated to Congress by the Constitution to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.

As a result of this power, Congress passed the patent laws and the copyright laws. Copyrights are granted to protect authors for twenty-eight years. Although originally only literary works were protected, the scope of protection has been extended to all sorts of creative works, plastic works, sculptures, photographs, movies, radio programs, and even the comic strips in the so-called "funny" papers.

There are five kinds of patents, viz., on (1) machines, (2) processes, (3) manufactured articles, (4) plants, and (5) designs.

The first four kinds of patents are granted for 17 years, but design patents are granted for various terms, such as $3^1/_2$, 7, or 14 years, depending on the period of protection desired and the fee paid. The Government fees are $10, $15, and $30, and, in addition, most attorneys usually charge from $35 to $50 for prosecuting a design patent application. This prosecution involves knowledge of the technique of Patent Office procedure and is a service for which the estimated charges which have been quoted are reasonable.

II. Copyrights and Patents

The essential differences between copyrights and patents can be best explained by considering the subject of photographs. Photographs can be copyrighted. It obviously would not be fair to grant to the first person who took a photograph of the Lincoln Memorial the exclusive right to sell photographs of the Lincoln Memorial just because he was the first one to photograph it. So in the case of copyrights, protection is only against copying. To infringe a copyright, the article copyrighted must be copied and not merely have similar subject matter. The protection afforded by patents is as to subject matter whether copied or not. Thus two people unknown to each other might write identical books. Each could be legally and properly copyrighted. But in patents, it is the subject matter which is protected, whether the later manufacturer knew of the patented device of the other or not.

Because of the general trend toward administrative control by passing administrative rules for questions formerly left to the courts, the Copyright Office has recently issued circular No. 82 in which it has merely stated that if a design sought to be copyrighted is for a useful article it can only be protected by a design patent. So what at one time was a possibility of legal protection, copyright for designs of articles possessing utility, has now passed into a doubtful category because of this administrative edict. There is no examination involved in connection with registration of a copyright, but applications for design patents are examined both for novelty and artistic merit.

In the present administration some persons feel that the good derived from patents is often not so great as the harm done by creating monopolies. This feeling is reflected in many recent decisions of the Supreme Court. But every time a Senate committee investigates patents, the small manufacturer is found to benefit the most, so no changes in the law have been made. But the courts pretty generally are treating patents with suspicion.

Design patents also have been affected by the trend of decisions applied to mechanical and process patents, and are being held invalid more and more, often quite arbitrarily.

Design patents are granted for designs for useful articles. As articles such as paperweights, bookends, containers, and fabrics are considered to be useful, practically any design for any article can be patented, because there is scarcely any article which will not funtion as a paperweight or bookend.

* Presented at the Forty-Fourth Annual Meeting, The American Ceramic Society, Inc., Cincinnati, Ohio, April 22, 1942 (Art Division). Received April 22, 1942.

In our early history, there was little limit to the designs which could be protected by design patents. They were often used to protect a useful function of the article which otherwise possessed no artistic merit. Finally, about forty years ago, one of the circuit courts of appeals declared a design patent on a horseshoe nail invalid, not because it was *not* a useful article, but because the patentee was trying to protect a mechanical function of the nail under the guise of an artistic design. After that, the courts quite generally adopted the rule that a design patent, to be valid, must have aesthetic qualities which are pleasing to the sense of sight. Since then, they have been stumbling back and forth in an unsuccessful attempt to lay down some standards of design patentability.

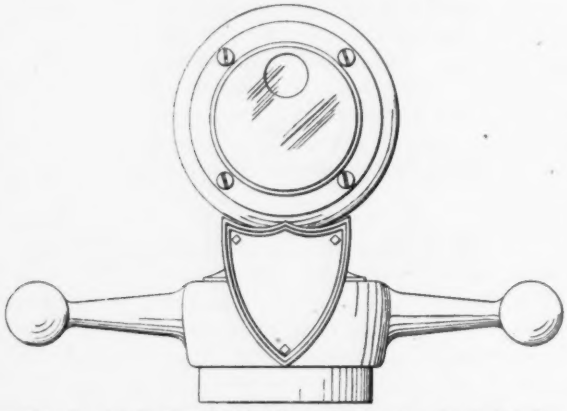

FIG. 1.—U. S. Pat. 60,878 for radiator cap, H. S. Pardee, J. A. Dewire, and J. W. Suporter, April 18, 1922 (July 9, 1921).

Drawings of some designs which have been patented and in which the patents have been held valid and infringed by the highest courts before which litigation on these patents has been brought are presented to explain more easily the underlying principles of design patentability.

Design patent No. 60,878, a design for a radiator cap, is shown in Fig. 1. It is the old Boyce Moto Meter. A court of appeals held the patent to be valid and infringed as follows:

The patent covers only a design substantially as shown, and the novelty, if any, is in the combination as a whole—in the complete picture presented thereby. To hold that another manufacturer may not for ornamental purposes position the figure of a bird or dog on the central portion of his radiator cap would be quite as preposterous as to say he could not put the figure of a shield on one of the terminating armknobs.

Considering the simplicity of the device, the fact that both separately and in combination all the elements thereof, with the exception of the plate, were old in the art and that a shield is a common decorative figure, independently we would have grave doubt whether the plaintiff's cap exhibits patentable novelty, but such novelty has been recognized by the Patent Office in several judicial decisions and apparently has received no little public approval.

FIG. 2.—U. S. Pat. 70,209 for wedding ring, J. Berlinger, May 25, 1926 (April 19, 1924).

In design No. 70,209 for a wedding ring (Fig. 2), the artist has reversed, in alternate positions, the well-known "heart" motif. A district court held the patent valid and infringed, stating:

That a heart or hearts undoubtedly have been used in forming designs for various purposes, including wedding rings, cannot be questioned, but not in the manner of the patent in suit; and the artistic merit of the design cannot be denied simply because it might not appeal to the taste of everyone; on the contrary, it seems to me that it is a design of a new and ornamental shape and does possess artistic merit and that the designed arrangement represented more than the mere skill of one versed in the art.

A distorted, octagonal, frustrated, conical shape is shown in design No. 85,189 (Fig. 3), a design for an ice-cream confection. A district court held the patent valid and infringed and expressed its opinion as follows:

That the evidence concerning the well-known "jelly apple" on a stick discloses clearly that it is similar in many respects to the well-known candy lollipop, and that the "jelly apple" is as different from the confections manufactured under the patents here in suit as is the candy lollipop.

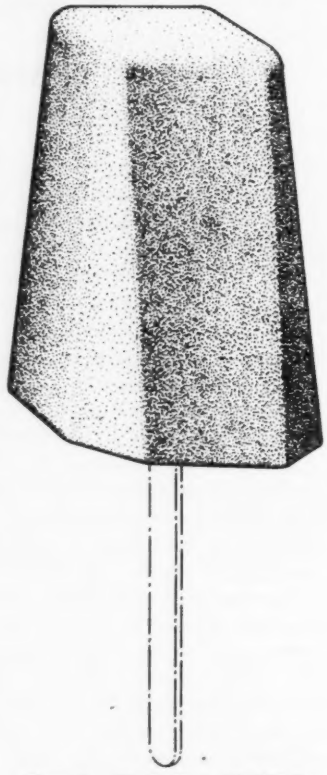

FIG. 3.—U. S. Pat. 85,189 for confection, L. B. Krick, Sept. 22, 1931 (Oct. 8, 1930).

Design No. 64,568 (Fig. 4) is a design for a bottle. A court of appeals held the design patent valid and infringed and stated:

The courts have invariably held that a design patent appeals solely to the eye. The appearance is the essential consideration. It is not necessary for a design patent that all of the elements of the design be new; it is essential that the elements, whether new or old, be grouped or combined in such a manner as to produce a pleasing appearance, different from what has preceded it. The fact that the elements of a design patent were old does not establish want of invention in assembling them. The decisive question is whether or not the design imparts a pleasing impression to the eye of ordinary observers.

Design patent No. 75,682 for a fruit-juice extractor is shown in Fig. 5. The court discussed the facts and the law as follows and held the patent valid and infringed:

The prior art does not disclose a fruit-juice extractor so pleasing in appearance as the plaintiff's design. Its simplicity is marked. The form and configuration and the relative proportion of the parts one to another are new and not found in any of the prior patents; not that it contains any specially artistic embellishments, but it is well shaped and well proportioned and is a marked advance over any prior patents and shows more than mechanical skill. It is a new creation, and the plaintiff's patent is valid. . . .

The defendant has not only copied the form, shape, and general dimensions of the plaintiff's construction closely,

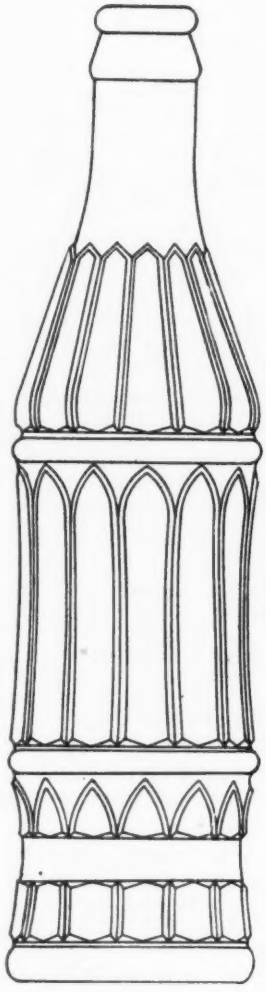

FIG. 4.—U. S. Pat. 64,568 for bottle, F. W. Schwenck, April 29, 1924 (Feb. 13, 1924).

but he has copied other features. There is only a slight difference in the color of the standard; the shape of the name plate is very similar and its place upon the standard is the same; the position of the switch in relation to the name plate and the spout is the same. The defendant's and plaintiff's structures have gray cords coming out of the standards at a like place. So that the defendant's structure is not only similar in shape and dimensions, but it is generally similar in all other respects and has the sameness of appearance.

Is this similarity such that the public is likely to be deceived? It is true that if the two constructions are placed side by side, the careful observer would see the slight differences in appearance, but if an ordinary buyer should go into a store to purchase the one, it seems to me that he could easily be deceived and buy the other.... It is sufficient to show that the natural and probable result of the defendant's conduct will be to lead the public to purchase his goods in the belief that they are the goods of the plaintiff....

Design patents No. 78,777 (Fig. 6) and No. 78,695 (not shown) involve the same design principle applied to a fountain pen and pencil. The court stated as to these designs:

The essential characteristic of the plaintiff's designs is a tapering along the line of a continuous curve somewhat in the nature of a parabola which, coupled with the thickness of the barrel, gives a distinct impression. This is modified somewhat in the pencil where the structure requires a point at one end, but even there the continuity of line is preserved.

Both patents were held valid and infringed.

A district court held design patent No. 80,059 for a smoking stand (Fig. 7) valid and infringed, stating in its opinion:

Design patents are usually judged by the effect they have on the eye, whereas other patents are usually judged by the use to which they may be put. Judge Hough, in Wilson v. Haber Bros. (C.C.A. 2) 275 F. 346, 347, pointed out the difference between design patents and other patents as follows: "Whether the problem be of validity, scope, or infringement, the prime difference between patents for other inventions and those for designs is that in the first class the inquiry is, 'What will it do?' whereas in the respect of design one always asks, 'How does it look?'" Design patents are granted as a reward for the giving of a new and pleasing appearance to an article of manufacture, whereby its sale is enhanced. . . .

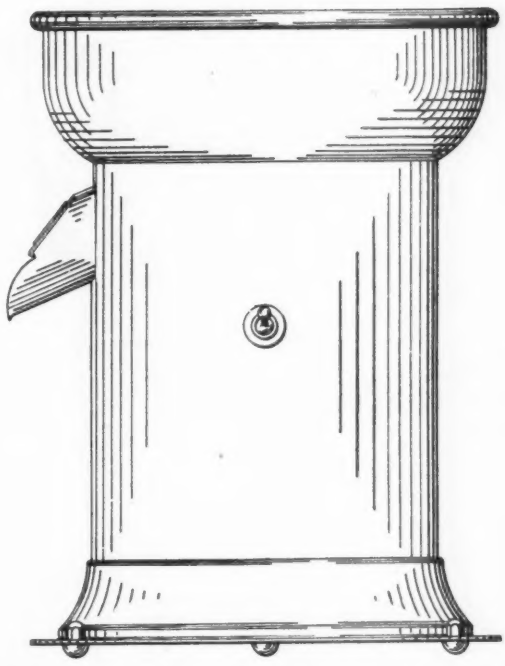

FIG. 5.—U. S. Pat. 75,682 for fruit-juice extractor casing, A. C. Gilbert, July 3, 1928 (March 24, 1928).

Both the plaintiff's smoking stand and the defendant's smoking stand have the same design as a whole, a flat base, spherical object on the center of the base, small pedestal on top of the spherical object, an upstanding nude figure on tiptoe on the pedestal with back arched, head tilted back, facing upwardly and forwardly, arms upstretched outwardly with palms turned inwardly holding a cup or tray for the receptacle proper. While minor differences can be pointed out, looking at plaintiff's smoking stand and defendant's smoking stand as a whole, they give the same impression and have the same appearance.

An unusual pair of designs, patents No. 85,815 (Fig. 8) and No. 85,816 (not shown), which appear chiefly mechanical, for a tow car and trailer were held valid and infringed by a court of appeals which held:

The design is graceful and pleasing, and while many of its elements were old in allied designing arts, we cannot say that the conclusion of the Patent Office that there is invention in the combination is shown to be wrong. There is no clear anticipation proved. The trailers made by the defendant differ in some respects, especially in the placing and spacing of the openings and in making the prow lines slightly curved instead of like the straight-sided V. The general appearance is very much the same, and likely to deceive ordinary buyers. The general appearance rather than minute details constitute the substance of a design patent and its imitation an infringement. . . .

A design for a sandwich toaster and tray, No. 96,481, is shown in Fig. 9. A circuit court of appeals held the design patent valid and infringed, stating:

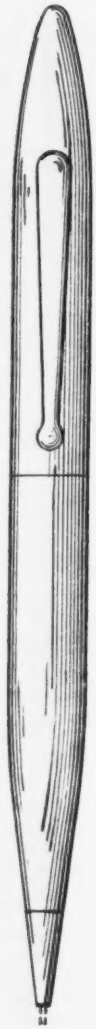

FIG. 6.—U. S. Pat. 78,777 for pencil, H. C. Mundstock, *et al.*, June 18, 1929 (Nov. 21, 1928).

FIG. 7.—U. S. Pat. 80,059 for smoking stand, A. von Frankenberg, Dec. 3, 1929 (May 15, 1929).

The design was for a novel combination of tray and toaster, low, compact, small, smooth, and neat with embossing on the tray and the top of the toaster and on the handles, the whole structural design appealing to the eye with the upper part coming entirely down toward the base and harmonizing with it. It had the appearance of stability and long-wearing life, with a smooth-curving contour and contrasting colors of metal and black.

Section 4929, R.S. 35 U.S.C.A. §73, the statute which authorizes the granting of a design patent, requires that the design to be inventive must be new, original, and ornamental and R.S. §4893, 35 U.S.C.A. §36, requires that the invention be sufficiently useful and important before the Commissioner is required to issue a patent therefor. Every new design of an article manufactured is not patentable. It was the intent of the Congress in the adoption of the design patent law to encourage ornamentation and beautification in manufactured articles so as to increase their salability and satisfy the aesthetic sense of the purchasers.

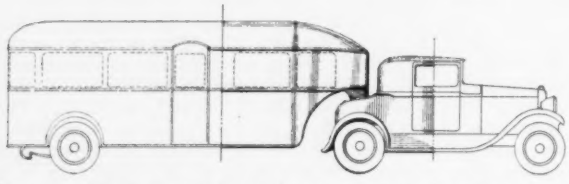

FIG. 8.—U. S. Pat. 85,815 for tow car and trailer combination, G. H. Curtiss, Dec. 22, 1931 (Jan. 8, 1931).

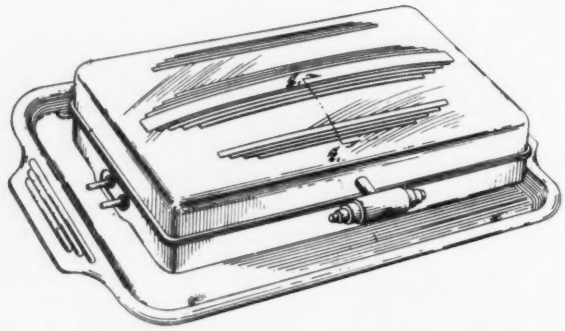

FIG. 9.—U. S. Pat. 96,481 for combined sandwich toaster and tray, A. S. Knapp, Aug. 6, 1935 (May 21, 1935).

The inventive designer need not possess the skill of a great artist or sculptor, but he must possess more skill than a mechanical engineer or metallurgist. A true standard to furnish a rule for the settlement of all cases in advance as to the degree of ornamentation and originality required for patentability in manufactured articles is not possible. The applicability of the Statute is as broad as the varying aesthetic tastes of the buying public for new things.

Figure 10 shows design patent No. 110,355 for a hamper. A district court held the patent valid and infringed, and in its opinion held:

The legs in the plaintiff's hamper are relatively short and rounded to conform to the edges of the hamper and extend from front to back as a single strip, whereas the legs in defendant's hamper are longer, are rounded to conform to the ends of the hamper, and do not extend from front to

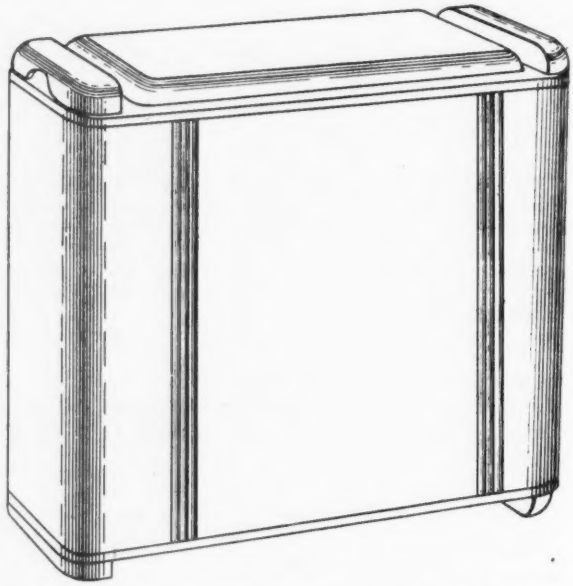

FIG. 10.—U. S. Pat. 110,355 for hamper, H. Gleitsman, July 5, 1938 (Feb. 4, 1938).

back; except for this difference, the hampers are substantially identical in appearance, and viewed from the front this difference in the structure of the legs is not apparent.

The proper test to be here applied is whether the impression made on the mind of the ultimate purchaser of the design of the alleged infringing article is the same as that of the patent in suit and whether the average purchaser seeing one structure would mistake it for the other, and that, it appears to me would happen in the present case, because I cannot believe that the showing of chromium strips on the handles of the alleged infringing structure, the difference in the legs, and the provision of a chromium strip in the central groove of the alleged infringing structure would tend to prevent the average purchaser seeing one structure from mistaking it for the other.

Design patent No. 93,757 for a match holder is shown in Fig. 11. This patent probably most clearly expresses the author's idea of an obvious meritorious design patent. The court held:

Due to the coverage of a design patent—to the fact that the patent is intended to protect an article which is ornamental and its salability dependent on the pleasing effect of its novel ornamentality, the test of infringement must be the effect produced upon the eye of a prospective purchaser who for the first time sees the two articles and is pleased to the point of buying. Would such a prospective purchaser be confused by the similarity of the two match holders? . . . .

However, the evidence throughout the record suggests that the inventor hit upon a happy idea when he designed this match holder. In other words, the article was extensively sold because of its novel and ornamental features, which intrigued the eye and caught the fancy of a prospective purchaser.

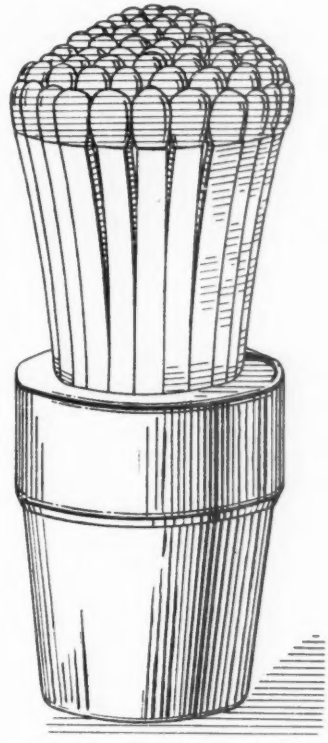

FIG. 11.—U. S. Pat. 93,757 for match-holder display, M. A. Bell, Nov. 6, 1934 (June 2, 1934).

III. Conclusion

Design patents stand in the same field of hazard as other kinds of patents. The desirability of obtaining design patents depends on the trade situation involved. Are other manufacturers likely to copy your design? A design patent is the only legal protection which you can obtain.

ALLEN & ALLEN
706 GWYNNE BUILDING
CINCINNATI, OHIO

INDUSTRIAL USE OF PLASTICIZERS, BINDERS, AND OTHER AUXILIARY AGENTS*

COMPILED BY JOHN W. WHITTEMORE

During the 1944 Annual Meeting of The American Ceramic Society, all those persons interested in the use of plasticizers, binders, and other auxiliary agents met together to discuss this subject. Because of the interest manifested by those present, it was decided that it would be worth while to have all those interested send all of the information they had on each of the several agents.

A questionnaire requesting such information was sent to all members of the White Wares Division, and the results were consolidated. No attempt was made to edit the remarks of the several persons, as the intended meaning of the person might be changed. It has been agreed that in this report the names of the persons should be withheld so that they would feel more free to give the maximum information regarding each of the agents.

AEROSOL

1. Is a good wetting agent.
2. A wetting agent using 0.1 to 0.2%.
3. Used in an attempt to improve covering power in glazes.
4. Has been used to reduce the amount of water required in bodies to be formed under pressure in steel molds and to improve pressing characteristics. It is interesting to note that the use of wetting agents in this manner affords a means of shrinkage control.

ALPHASOL OT

1. 0.1 to 0.2% increases plasticity of mix.
2. The addition of 0.1% in a ball clay-flint mixture increases the plasticity as determined by the Brabender Plastograph.

ALUM

1. The addition of alum served to make the body stronger, but when it was used the slip was so much more harmful to the filter cloths and lawn cloths that it was discontinued after only a few months' use.
2. The addition of 0.1% in a ball clay-flint mixture increases the plasticity as determined by the Brabender Plastograph.

* Received September 26, 1944.

ALUMINUM CHLORIDE
1. Used in place of sodium silicate and soda ash.
2. May be used as an electrolyte for adjusting the consistency of glaze slips. Has some bonding properties in bodies owing to the hydrolysis and function of alumina gel.

ALUMINUM PHOSPHATE (mono- or sesqui-)
1. Forms excellent dry bonds in clay bodies. Flocculates clays. Reacts very slowly with alkaline earth compounds in the wet condition. Reacts very slowly with clays in the wet condition. Forms sticky solutions similar to silicate solutions.

ALUMINUM STEARATE
See *Stearates*.

AMMONIUM CITRATE
1. Use 0.3 to 1.5% with hotel china body. Slowly flocculates. After one week slip is solid.
2. Excellent deflocculant for hotel china body in amounts around 0.4%.

AMMONIUM HYDROGEN PHOSPHATE (mono- or di-hydrogen)
1. Produces dry bond in refractory cements.

AMMONIUM OXYLATE
1. Use 0.3 to 1.5% in hotel china body. Does not thicken on standing.
2. Excellent deflocculant in hotel china body in amounts around 0.4%.

AMMONIUM TARTRATE
1. Use 0.3 to 1.2% in hotel china body. Does not thicken on standing.
2. Of value in chinaware bodies.
3. Excellent deflocculant in hotel china body in amounts around 0.4%. Dry and fired strength of fire-clay-grog refractory increased about 10% by an addition of 0.2%.

ARESKAP 50
1. 0.1 to 0.4% increases plasticity.
2. In plastic body decreases water of plasticity and increases range of water content over which body can be worked. Decreases extrusion pressure. In amounts of 0.2% in a dry-press body increases dry density of pressed body.

BADILLA (a hydrous magnesium silicate gel)
1. More of a lubricant than anything else. Adds little or no dry strength to a ceramic body.

BAKING FLOUR
1. Lubricant and bonding agent. Plasticizer for pugging. Produces very high dry bond strength. 3.5% sufficient to permit pugging of nonplastic mixes. Uniform dispersion very important. Skin hardness objectionable to subsequent forming operations. $1^1/_2$% satisfactory for lathe turning. Maximum strength obtained by preparing a cooked paste cereal mill flour. Similar to baking flour. High bond strength without cooking.

BARIUM ALUMINATE
1. May be used to prevent sulfate scumming.

BARIUM CARBONATE
1. Use 2 lb. to 2400-lb. charge. Formerly used 12 lb. Cutting to 2 lb. apparently made no change.
2. Of value in sanitary ware.
3. By using 0.2% barium carbonate in the scrap recovery batch, I can use up to 30% scrap in the cast batch without affecting the casting behavior of the slip, whereas without the barium carbonate our limit was 10% when the water was free from chlorine and no scrap whatever when the water was chlorinated without excessive settling of the inert materials in the slip.
4. May be used to prevent sulfate scumming.

BARIUM CHLORIDE
1. May be used to prevent sulfate scumming. In a plastic brick clay 0.4% increases dry strength.

BENTONITE
1. Adds plasticity but will cause blisters and some warping and cracking if used in large amounts. $^1/_2$ to 2% usually beneficial. (Nonswelling bentonite seems to have less plasticity than the regular bentonite but does not cause as much warping or cracking.)
2. Increases dry strength of glaze, i.e., rub resistance. Holds heavy materials in suspension.
3. A binder. Has been added to glazes to improve hardness before firing.
4. As a glaze-suspending agent.
5. Varying from 1 to 75% of the bonds only. Bentonite and Eyrite are used as bond-forming minerals, as plasticizers, as dry-strength developers, as moisture-holding materials to help hold wheel mixtures in workable state before pressing and after mixing.

BLACK ASH (a waste recovery from caustic)
1. Use 0.1 to 0.4%. Increases stiffness of plastic mixes. Releases H_2S from mix.
2. Used to prevent sulfate scumming. In plastic brick clay, 0.2% increases dry strength. Acts as a stiffener in soft-mud brick batches.

BINDEX
1. 4% of Bindex in plastic faience body increases plasticity of clay. Amount of increase was not measured.
2. Hardening agent for dry- and dust-pressed bodies. Use 5 to 3%. High dry strength for casting bodies.
3. Use 0.25 to 0.5% Bindex in "short" bodies to increase dry strength to facilitate handling and then only for the larger shapes.

C–35 (Monsanto Chemical Co., St. Louis, Mo. Also C–35–10–P)
1. Hardening and plasticizing agent for dry-pressed bodies. Use 2% based on dry weight of body.
2. Used in casting slips both C–35 and C–35–10–P. These materials have the odor characteristic of fish glue and have a slight deflocculating effect on the bodies, as well as a tendency to strengthen cast ware during the period at which it releases from the mold.

CALCIUM CHLORIDE
1. Excellent flocculant in glaze slip.

CALCIUM STEARATE
See *Stearates*.

CALGON (sodium hexametaphosphate)
1. Added in very small amounts, e.g., 2 oz. in 400 lb. of dry material, will retard or prevent formation of lime nodules in glazes. This is a rare occurrence.
2. Use 0.3 to 1.5% good deflocculant properties with hotel china body. No jelling on standing for one week.
3. Excellent deflocculant in hotel china body in amounts around 0.4%. Can be used with good results to deflocculate some talc-bearing casting bodies.
4. To prevent the formation of calcium concretion in a lead-zinc glaze.

CARNAUBA WAX
1. 2% with 3% paraffin dissolved in tetrachloride for nonplastic powders.
2. Two parts paraffin and one part carnauba wax used as temporary binder with approximately 17 parts ceramic body material. Covered by U. S. Pat. 1,847,197. (Paraffin has been used experimentally without other wax as covered by U. S. Pats. 1,847,102 and 1,977,698. The latter patent covers the use of an emulsion of paraffin in water with emulsified agents such as triethanolamine and stearic acid.)

CARBOWAX
1. 4 to 5% for pressing moisture-free bodies rapidly.
2. Water-soluble internal lubricant and bond for dry-press mixes. (Fast pressing.) Increases workability in plastic bodies.
3. 6% gives a good binder and lubricant for nonplastic fine powders.
4. Internal lubricant for dry-press mixes. 0.5 to 2.0% satisfactory.

CELLULOSE ACETATE
1. Thermoplastic dry-press body binder. Serves as a lubricant under heat and pressure. 5 to 10% produces sufficient strength for lathe turning. Can be added as a solution prepared from dimethyl ketone.

CERE AMIC FLOUR (Illinois Cereal Mills, Inc., Paris, Ill.)
1. Laboratory use. For extrusion purposes, to be very satisfactory for use in steatite porcelain.
2. 2 to 3% or 2% with 0.7% polyvinyl alcohol for bodies or glazes with little or no clay content.
3. Binder for low ball-clay bodies, 4% for dry press, 3% for extruding.
4. 3% for extrusion.
5. 2% Cere Amic flour and 1% dextrine for steatite bodies, plastic extrusion.

CEREDEX (corn flour)
1. Plastic binder for dry- and dust-pressed bodies. 5 to 6% increases plasticity and dry strength.

CEREMUL C WAX (Socony-Vacuum Oil Co., New York, N. Y.)
1. 3% plus 17% Mogul gum to produce granules for dry pressing.

CERESIN WAX
1. 8% (dissolved in carbon tetrachloride) as binder for bodies or glazes with little or no clay content.

CLAY DEFLOCCULANTS NOS. 2 and 5 (R. T. Vanderbilt Co., New York, N. Y.)
1. Used as dispersing agents in all types of whiteware bodies.
2. Use 0.57% in semivitreous casting body. Gives a safer and longer casting range than silicate of soda and soda ash combinations, but does not give as much fluidity to the casting slip, as measured by a viscosimeter, as could be obtained with silicate and soda ash.

COLD-WATER PASTE
1. Lubricant and bonding agent. Plasticizer for pugging. Produces very high dry bond strength.

COPACITE
See *Ligninsulphonate.*

CORN FLOUR
See *Cere Amic Flour.*

DAXAD NO. II
1. Use 0.3 to 1.5%. Better than Daxad No. 23 with hotel china body. Does not jell on standing.
2. Excellent deflocculant in hotel china body in amounts around 0.4%.
3. Use 0.6% as deflocculant for low clay casting slips. No advantages over K_2SiO_3, Na_2CO_3, or Na_2SiO_3.

DAXAD NO. III
1. In ball clay-flint mixes decreases plasticity as measured by the Brabender Plastograph.
2. Use 6% as deflocculant for low clay casting slips. No advantages over K_2SiO_3, Na_2CO_3, or Na_2SiO_3.

DAXAD NO. 23
1. Use 0.3 to 1.5%. Does not jell on standing.
2. Good deflocculant in hotel china body in amounts around 0.7%.

DEXTRINE
1. 1% adds plasticity and dry strength to talc body low in clay.
2. White and yellow potato dextrine, high dry-strength agents.
3. 2% and 0.7% starch (cooked in water) as binder for bodies or glazes with little or no clay content.
4. 3% for extrusion.
5. 1% dextrine and 2% Cere Amic flour for steatite bodies, plastic extrusion.
6. Not as effective as lignin extract.
7. Excellent dry bond. Skin hardening objectionable for subsequent forming operations. 2% suitable for lathe turning.
8. Binder. Has been added to glazes to improve hardness before firing.
9. Varying from 1/2 to 4% of the entire grinding wheel mixture.

DIETHYLAMINE
1. Good deflocculant in hotel china body in amounts around 0.15%.

DIETHYLENE GLYCOL
See *Stearic Acid.*

DIGLYCOL STEARATE
1. Good internal dry-press body lubricant. Does not contribute to dry strength. 1 to 10% suitable additions.
2. Lubricants: diglycol stearate, as well as emulsions formed of stearic acid in water by use of triethanolamine, has been used successfully in bodies as a mold lubricant. The conventional usages of mixtures of lard oil and kerosene are also common.

DI-*n*-PROPYLAMINE
1. Good deflocculant for hotel china body in amounts around 0.15%.

EMULSIFIED ASPHALT (tar or pitch)
1. Commonly emulsified with bentonite. The material mixes readily with water. In crucible bodies it dries to a hard tough bond.

EMULSIFIED PARAFFIN OR WAX
1. See *Paraffin.*
2. Good internal dry-press mix lubricant. Does not contribute to bond strength. 1 to 3% satisfactory.

EMULSIFIED ROSIN
1. Mixes readily with water. Dries to a hard tough bond.

ETHYLENEDIAMINE
1. In experimental stages but appears to be good.

ETHYL SILICATE
1. Soluble in alcohol. Hydrolyzes on dilution with water to produce silica gel which has dry bonding properties.

EYRITE (a colloidal calcium magnesium silicate) (F. E. Schundler & Co., Inc., Joliet, Ill.)
1. Varying from 3 to 25% of the bonds only we are the first to make industrial use of the Eyrite in ceramics. I ran tests using Eyrite with one of the leaner kaolins. I ran the dry modulus, 50% flint and 50% kaolin from 50 to 900 with zero to 10% Eyrite. Best value with the Eyrite about 6%. (Whiteware.)
2. Experimentally used 1 to 2% Eyrite in dry-pressed floor tile. It imparts great green strength so talc can be handled with ease and acts as an auxiliary flux like talc when used in combination with feldspar.
3. 1 to 5% imparts plasticity and workability to otherwise nonplastic bodies. Increases dry strength.

FERRIC CHLORIDE
1. Effective in improving drying properties of brick clays. Reduces warpage and cracking of some Florida brick clays that are very difficult to dry. Very corrosive.
2. Improves drying properties of high-shrinkage brick clays. Reduces lime popping.

FRIT
1. Delayed deflocculant in whiteware bodies.

GLUCOSE
1. Binder for automatic machine dry pressing of intricate-designed pieces.

GLUTRINE
1. 0.5% glutrine (dry-wt. basis) in sagger body mix. As a binder.
2. Glutrine and Gulac 0.5 to 2%. Increases dry strength. A binder.
3. Used 3/4 of 1% glutrine as a binder in dry-press porcelain with good results.
4. Sulfite liquor product. 1/2% increases dry strength of a ceramic body greatly. It tends to come to the surface on drying.

GLYCERINE
1. Glycerine in small percentages, based on entire wheel mixture.

GRAPHITE
1. Good internal lubricant. Up to 10% usable but not desirable in this quantity for firing reasons.

GUANIDINE CARBONATE

1. Range narrow. Slip thickens about 0.7%.
2. Excellent deflocculant in hotel china body in amounts around 0.4%.

GULAC (GOULAC)

1. Glutrine and Gulac 0.5 to 2% increases dry strength. Binder.
2. 4% to produce granules in dry pressing.
3. A dry-press body binder. 0.5% produces good dry strength.
4. In addition to Gulac, we use a solution in water, 50/50, and another 7½% Gulac and the rest water. Varying from ½ to 4% of the entire wheel mixture.

GUM ARABIC

1. Suitable for electric porcelains.
2. Or starch 1 to 2% for dry-pressing bond.

GUM GHATTI

1. A water bulking gum similar to gum arabic or gum karaya. Tends to cause warpage if too much is used in a ceramic body. Gives a strong body in the dry state if added in amounts between ½ and 3%.
2. 0.5 to 1.0% satisfactory in dry-press mixes for lubrication and dry bond. Skin hardness objectionable.

GUM TRAGACANTH

1. 1% is used in sprayed clayless glazes.
2. Bonding agent for nonplastics, 1 to 3%.

HYDROCHLORIC ACID

1. In shale brick 0.2% nearly doubles dry strength.

KELGIN

1. Water-retention agent and plasticizer, 0.25 to 2.0%.

LARD AND KEROSENE

1. To a steatite composition (in pilot-plant production) we are adding lard dissolved in kerosene. This is prepared by dissolving 10 parts leaf lard in 100 parts kerosene and is added to the pressing granulation (−20 plus 100-mesh) by spraying 20 cc. per kilogram over the prepared granulation. This granulation lubricant permits the fast pressing of parts with small, detailed embossing or countersunk sections.

LARD, KEROSENE, AND STEROTEX

1. 1½% of equal parts of each produces a good internal dry-press body lubricant.

LIGNIN EXTRACT

1. Binder. Lignin extract 0.1 to 0.5% increases dry strength.
2. Both liquid and dry 1 to 3% increases unfired strength of abrasive products.

LIGNINSULPHONATE

1. We use a small quantity in our glazes to make them adhere to the ware (clay state). We have tried this material in our slip but it appears to work against the deflocculants. It seems to strengthen.
2. (Basic Calcium) Forms excellent dry bond in clay bodies. Generally very minor deflocculating effect. 0.3% addition increases dry strength 50 to 60% with improved drying characteristics.
3. (Neutral Calcium) Water soluble, forms excellent dry bond in clay bodies; also suitable for use as a binder and hardener in slips and glazes. Additions of 0.2 to 0.3% increase dry transverse strength around 75% with improved drying characteristics.
4. (Sodium) Water soluble, excellent deflocculant in amounts around 0.7%. Also develops usual lignin bonding and hardening effect with improved drying characteristics.

LIQUID LATEX

1. 2.5% produces some internal lubrication. Does not contribute to dry strength.

MAGNESIUM STEARATE

1. We are using magnesium stearate as internal lubricant in dry-press semisteatite compositions in amounts up to 1%.
2. Internal lubricant for dry-press bodies (fast pressing).
3. Used in amount of 0.25% of weight in steatite molding compositions containing wax to produce self-lubrication and fast automatic pressing. Use in ceramic compositions covered under U. S. Pat. 1,847,196.

MARATHON EXTRACT No. 125 C (Marathon Chemical Co., Rothschild, Wis.)

1. Use 0.05% in stoneware clay. Increases green strength 30 to 40%.

MERPENTINE

1. Wetting agent added to casting body in amounts around 0.05% increases dry strength, pH, and viscosity (slightly) and decreases casting time. In a plastic body it decreases water of plasticity, increases range of water contents over which body can be worked, and decreases extrusion pressure. In a ball clay-flint mixture, reduces plasticity as measured by the Brabender Plastograph. Is beneficial in graphite and silicon carbide bodies.
2. 0.2% increases plasticity and dry strength of low clay pugged bodies.

METHOCEL

1. Increases plasticity. Excellent dry bond. Reduces surface tension. Is good emulsifier. Becomes insoluble in hot water and forms a gel. This tends to retard the migration of soluble constituents to the surface during drying.

MOGUL GUM

See *Ceremul C Wax*.

MOLASSES

1. Binder. Has been added to glazes to improve hardness before firing.

MONTMORILLONITE

1. Experimental use only.

MONOAMYLAMINE

1. Good deflocculant for hotel china body in amounts around 0.15%. In a fire-clay-grog refractory, 0.2% decreases dry strength but increases fired strength.

MONOETHYLAMINE

1. Good deflocculant for hotel china body in amounts around 0.15%. Excellent deflocculant in talc-bearing semivitreous bodies in amounts as low as 0.1%. Added to fire-clay-grog body, 0.2% increases dry strength 148% and fired strength 77%.

MONO-*iso*-BUTYLAMINE

1. Good deflocculant for hotel china in amounts around 0.15%.

MONO-*n*-BUTYLAMINE

1. Good deflocculant for hotel china body in amounts around 0.15%. Added to fire-clay-grog refractory, 0.2% increases dry and fired strengths.

MONO-*n*-PROPYLAMINE

1. Good deflocculant for hotel china body in amounts around 0.15%.

MONO-*sec*-BUTYLAMINE

1. Good deflocculant for hotel china body in amounts around 0.15%. Added to fire-clay-grog refractory, 0.2% increases both dry and fired strengths.

OILS

1. Oils 1 to 3%. All oils have good lubrication qualities but are deleterious to binders used.
2. Soluble oil good internal dry-press body lubricant. 1% is a satisfactory addition.

ORVUS (made by Procter & Gamble, New York, N. Y.)

1. Before using the Orvus wetting agent (7½ gm. to 2400-lb. slip charge) we had trouble getting the talc to mix with the water. It took 3 to 4 hours to add the 32 50-lb. bags to the water. Using the Orvus, within 20 to 30 min. (or as fast as one man can empty the sacks) the talc is completely wetted and in suspension and 800 lb. of air-floated ball clay can be introduced as fast as sacks can be emptied. Within an hour our slip is completely free of lumps.

PARAFFIN

1. 3% paraffin dissolved in tetrachloride with 2% carnauba wax for nonplastic powers.
2. Emulsified paraffin or wax. Internal lubricant and bond for dry-press bodies.

3. See *Carnauba Wax* and *Zophar C–49 Wax*.

PLASKON THERMAL PLASTIC

1. Thermoplastic resin. A lubricant under heat and pressure. Binder after cooling.

POLYVINYL ALCOHOL

1. See *Cere Ami Flour*.
2. Good dry bond for glazes. Produces no frothing. Can be mixed with a spray on glaze coating. Good intermediate coating between sprayed and majolica colors.
3. A binder. Has been added to glazes to improve hardness before firing.
4. As glaze-suspending agent.

RED GUM

1. Nonwater-soluble, thermosetting gum. When added to a body in amounts of about 5%, it produces a strong body after baking at 300°C., but the firing shrinkage is high.

SANTOMERSE (Monsanto Chemical Co.)

1. 0.1% of Santomerse (dry-wt. basis) in an all-clay body. As a wetting agent (ball and china).
2. "S" 34 cc. per 1000 lb. dry material in talc body speeds wetting of particles.
3. Wetting agent. 0.2% in all dry-mix bodies. Especially beneficial in sawdust bodies. Pressing moisture reduced 1 to 3%. Higher dry bulk specific gravity, less lamination, shorter aging time.
4. Seems to have some effect in reducing water required to wet a ceramic body when used in amounts up to 1/2%.
5. A wetting agent. Has been used in an attempt to improve covering power.
6. In dry-press body decreases tempering water. 0.10% based on weight of water sufficient to reduce surface tension.

SETIT

1. 1/2 to 2% stabilizes and prevents settling of highly fritted glazes and acid-resisting vitreous enamels. Smaller amounts tend to increase the effectiveness of clay or supplemental flocculants.

SEVCO GUM

1. A binder. Has been added to glazes to improve hardness before firing.

SICAPON

1. A binder. Has been added to glazes to improve hardness before firing.

SODIUM ALGINATE

1. 0.5% to improve workability.
2. Experimental in casting slips. Imparts strength to the cast during the period at which it releases from the mold. It did not have a pronounced thickening effect on slips on which we tried it.
3. Added to dry-press mix, 0.2% dry density of dry-pressed body.

SODIUM ALUMINATE

1. 0.5% unsatisfactory as an internal lubricant for dry-press bodies. Did not contribute sufficient dry strength.

SODIUM HYDROXIDE

1. 108 gm. to 2400-lb. charge has helped the quality of our slip and has stopped a lot of "peeling" that we formerly had.

SODIUM METAPHOSPHATE

1. Forms excellent dry bonds in clay bodies. Does not react readily with alkaline earth silicates or with clays. Forms sticky solutions similar to those of sodium silicate.

SODIUM ORTHOPHOSPHATE

1. Added to shale brick 0.2% nearly doubles dry strength.

SODIUM SILICATE AND SAL SODA

1. Our plant used a combination of sodium silicate and sal soda in about equal proportions by weight in a whiteware body. The total weight per cent ranges between 0.25 and 0.35, depending upon conditions. Increasing sodium silicate over sal soda up to a minit increases the speed of casting and the toughness of the cast.
2. 0.101% of sodium silicate and 0.101% of sal soda give good results as electrolyte.
3. Used in normal fashion.

SODIUM SILICATE AND SODA ASH

1. Deflocculate with.
2. All that is used.
3. For a fire-clay body, a combination of sodium silicate and soda ash is used in the ratio of 1 to slightly less than 1. Total amounts vary with conditions between 0.18 and 0.2%.
4. Principal agent used.
5. Sodium silicate deflocculant for ceramic slips 0.2 to 0.3%. Soda ash 0.2 to 0.3%.
6. Sodium silicate in a fire-clay-grog refractory increases dry and fired strength. Combined with soda ash makes excellent deflocculant in amounts around 0.2%. Soda ash in plastic whiteware body decreases water of plasticity, range of water contents over which body can be worked, and extrusion pressure. Added to dry-press mix, 0.2% increases dry density of pressed body. In ball clay-flint mixture, 0.2% decreases plasticity slightly as measured by the Brabender Plastograph. Added to a fire-clay-grog refractory, 0.2% increases dry strength 90 to 130% with a slight increase in fired strength. Has the greater effects when hot water is used.

STARCH

1. There have been occasions when we found it advantageous to add soluble starch (preferably cooked cornstarch) to bodies low in plastic clays when we desired to produce a hard, strong pressing granulation. We use the wet process for body preparation and add 2% of starch at the ball mill. After filter pressing, approximately 1.6% starch remains in the cake.
2. Starch solution used in place of dextrine helps. Value between the two is in question. Source of starch and method of preparation are probably important.
3. We are using 5 to 6% of a soluble starch solution for our dry pressing of nonplastic bodies.
4. Use both dextrine and starch, but neither as effective as lignin extract to increase unfired strength of unfired abrasive wheels.

STEARATES

1. Zinc stearate, aluminum stearate, and stearic acid 1 to 2%. Good lubrication when used with very dry grains. Poor lubrication when used with damp grains.
2. We use zinc stearate lubricant for dry pressing, 0.50% approximately.
3. Use zinc stearate, 1/2 to 1%, in automatic dry press as a lubricant.
4. Stearates are internal lubricants for dry-press bodies (dry pressing). Calcium stearate internal lubricant in dry-press body. Zinc stearate internal lubricant for dry-press body.
5. Aluminum stearate, internal lubricant for dry-press body. Not as good lubrication as diglycol stearate or stearic acid as recommended solvents do not produce a solution for easy incorporation into the mix. Zinc stearate, internal dry-press body lubricant, 1/2% satisfactory in our applications.
6. Zinc stearate. Use approximately 0.3% by weight in wax containing composition such as paraffin and carnauba wax. Produces a self-lubricating, fast-pressing molding material. Covered by U. S. Pat. 1,847,196.

STEARIC ACID

1. Stearic acid 3% and diethylene glycol 1 to 2%, internal lubricant for dry-press bodies (fast pressing).
2. Good internal lubricant. Easy to incorporate in a dry mix as a solution.

STERATEX OR STEROTEX

1. For dry pressing lubricant 0.50% approximately.
2. Good internal lubricant for dry-press mixes. Easy to dissolve and incorporate. 1/2% is suitable.

SULFATATE

1. As a wetting agent it has been used in an attempt to improve covering power.

SULFITE PAPER WASTE

1. As a binder and bonding agent, 1 to 5%.

TERGITOL

1. A good wetting agent.
2. In plastic body, decreases water of plasticity, increases range of water contents over which body can be worked, decreases extrusion pressure.

TRIETHYLAMINE

1. Good deflocculant for hotel china body in amounts around 0.15%.

TRITON W–30

1. A wetting agent.

UREA

1. I understand urea has been used to prevent cracking on drying and that it will be available in quantity but have had no experience with it.

WAX

1. Water emulsions of wax 1 to 4%. Fair binding qualities, very poor lubrication qualities.

WETANOL

1. A wetting agent. Has been used in an attempt to improve covering power.

WHEAT FLOUR

1. 2% or more (cooked to a paste with dilute ammonia, Louis Navias, "Extrusion of Refractory Oxide Insulator for Vacuum Tubes," *Jour. Amer. Ceram. Soc.*, **15** [4] 234–51 (1932)) as binder.

ZOPHAR C–49 WAX

1. Zophar wax was introduced when carnauba wax was difficult to obtain. Use in ceramic compositions covered under U. S. Pats. 1,847,197; 1,847,102; and 1,977,698.

This compilation does not include any review of the literature on this subject. The reader is specifically referred to the work of Stone regarding auxiliary agents for steatite bodies[1] and that of Grupelli relative to emulsions.[2]

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[1] R. L. Stone, "Final Report on Shrinkage Control of Steatite Porcelain for Radio and Radar Equipment: II, Investigation of Binders, Lubricants, and Plasticizers for Dry-Pressed Steatite Bodies," *War Production Board*—46, *Office of Production Research and Development*—226, May 1, 1944, 71 pp.; *Ceram. Abs.*, **23** [10] 171–72 (1944).

[2] Logan Grupelli, "Can the Ceramist Use Emulsions?" *Bull. Amer. Ceram. Soc.*, **23** [8] 288–90 (1944).

TENTATIVE SPECIFICATION OF A STANDARD METHOD OF TESTING FOR TALC*

COMPILED BY CAPTAIN GLENN HOWATT

The following testing procedure has been designed so that the talc producer can analyze each car of talc before shipment and the consumer can run test checks on the talc after it has been received, using the same testing procedure.

(1) (*a*) Sampling by the talc supplier shall preferably be automatic and shall be adequate to furnish an accurate representation of the bagged talc.

(*b*) At least 10% of the bags of an incoming shipment shall be sampled by the purchaser. Sampling shall be accomplished using a pipe sampler to obtain a cross section of each bag sampled and to eliminate the necessity of opening the bag. The accumulated sample shall be coned and quartered until the correct-sized sample is obtained.

(2) A chemical analysis including analysis for soluble constituents and ignition loss shall be performed as follows:

(*a*) *Moisture loss at 105°C.:* Weigh out approximately 0.5 gm. of sample in a previously ignited and tared 15-ml. platinum crucible. Dry at 105° for 1 hour; cool in a desiccator and reweigh. Calculate loss in weight as per cent of original sample.

(*b*) *Ignition loss:* Ignite residue from moisture loss over the full blast of a Meeker burner until a constant weight is obtained. This usually requires approximately ½ hour. Calculate loss in weight in per cent as before.

(*c*) *Silica:* Thoroughly mix the residue from the ignition loss with approximately ten times its weight of sodium carbonate and ignite until a clear, quiet fusion is obtained. Dissolve in warm water and hydrochloric acid and dehydrate over a steam bath until dry. Take up with more water and acid and redehydrate. Again take up with warm water and dilute hydrochloric; filter off the precipitate and wash with dilute hydrochloric five times; then wash with warm water until free from chlorides. Save all the filtrate and the washings. Ignite the precipitate in a platinum crucible. Weigh, then add 5 drops of sulfuric acid and 10 ml. of hydrofluoric acid. Heat over a steam bath until dry. Then ignite to drive off all silica. Reweigh and calculate loss in weight as silica. If any residue remains in the crucible after the ignition, it should be fused with potassium bisulfate, dissolved in dilute sulfuric acid, and added to the silica filtrate.

(*d*) *Carried silica, iron, and aluminum oxides:* Boil the silica filtrate down to about 250 ml. and add about 5 gm. of ammonium chloride. While boiling, add ammonium hydroxide dropwise to precipitate the silica, iron, and aluminum hydroxides. Filter and wash the precipitate with hot water until free from chlorides. Place the paper and precipitate in a platinum crucible, char the paper slowly as the heat is gradually increased, and finally heat under the full blast of a Meeker burner for 5 or 10 minutes. Weigh as iron and aluminum oxides with some silica carried over in the silica filtrate. Add 2 drops of sulfuric acid and 5 ml. of hydrofluoric acid and evaporate to dryness. Heat gently at first until the sulfates are decomposed, then ignite for 3 to 5 minutes and reweigh. The loss is the silica correction and should be added to the silica determination. Fuse the oxides with potassium bisulfate, being careful to avoid any loss from sputtering. Dissolve the fusion in warm dilute sulfuric acid and transfer to a 250-ml. flask. Add 15 ml. of concentrated hydrochloride acid; then add stannous chloride solution dropwise until the iron is reduced. This point is reached when the yellow color of the ferric chloride disappears and is converted to colorless ferrous chloride. Be careful not to add too great an excess of stannous chloride. Oxidize the excess stannous chloride with 15 ml. of mercuric chloride. Add 3 drops of diphenylamine indicator and titrate the solution with 0.010 bichromate solution. The end point is a deep purple color. Calculate the amount of iron as Fe_2O_3:

$$R_2O_3 - Fe_2O_3 = Al_2O_3.$$

(*e*) *Lime:* The iron and alumina filtrates are combined and heated to boiling and boiled until all the ammonia is driven off. This should make the pH of the solution approximately 5. Next, add 20 ml. of saturated solution of ammonium oxalate dropwise and boil until the calcium oxalate takes on a dense granular appearance. Allow to cool and filter. If the precipitate is large it should be redissolved and reprecipitated to separate the occluded magnesium salts. Wash the precipitate with cold water until free from chlorides, then dissolve the precipitate in dilute sulfuric acid; heat to approximately 150°F. and titrate with 0.1 *N* permanganate solution. Calculate lime as CaO.

(*f*) *Magnesia:* The lime filtrate is evaporated down to about 250 ml. and made slightly acidic. Then 20 ml. of

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* This specification has been accepted by the White Wares Division and presented to the Board of Trustees for adoption by The Society. Received September 26, 1944.

saturated solution of ammonium sodium phosphate is added and the solution is boiled for 5 minutes. Cool to about 68°F. and add 10 to 15 ml. of ammonium hydroxide dropwise and with vigorous stirring. Allow the precipitate to settle and let set overnight. Filter through a Gooch crucible and weigh as $Mg_2P_2O_7$:

$$Mg_2P_2O_7 \times 0.3621 = MgO.$$

(*g*) *Alkalis:* Use the standard J. Lawrence Smith method.

(*h*) *Acid-soluble substances as CaO:* Weigh out exactly 1 gm. of talc and transfer to a 600-ml. beaker. Add 50 ml. of standardized 0.10 *N* sulfuric and 20 ml. of water. Boil for 1 minute. Wash down the sides of the beaker with water; add 3 drops of phenolphthalein solution and titrate with 0.10 *N* sodium hydroxide solution to a faint pink color. Then:

ml. of H_2SO_4 used in digestion $\times$ 0.281 = % acid solubles calculated as CaO.

(3) A pH determination shall be made on the talc as follows:

pH value: Boil 5 gm. of talc with 25 gm. of previously boiled distilled water for 5 minutes; filter under pressure and discard the first 20 ml. of the filtrate. The entire filter apparatus is inclosed in an airtight container so that the solution cannot absorb carbon dioxide from the air. The first portion of the filtrate is discarded because it has been found to be low in pH. The filtrate is caught in two 25-ml. Nessler tubes and phenol red is added to one and bromothymol blue to the other. The solutions are compared with standard buffer solutions.

(4) Pyrometric cone equivalents shall be determined using cones made from the talc alone, with 3% of Cere Amic flour as the binder. This test is optional.

(5) *Screen Analysis:* Standard Taylor Screens of 200 to 325 mesh shall be used and a 10-gm. sample shall be screened dry. Results shall be recorded as per cent retained.

(6) *Particle-Size Distribution:* Use the regular hydrometer method as follows:

Add 2 gm. of Daxad No. 23 to 800 ml. of distilled water in a liter flask and agitate until dissolved. Pour part of the solution into a beaker and add 40 gm. of talc to the solution in the flask; shake thoroughly until all the talc is wet and all flocs are broken up. Transfer the mixture to a 1000-ml. hydrometer jar and rinse out the flask with the solution in the beaker, adding all the solution and washings to the jar. Close over one end of the jar and agitate by tilting until all the talc is in suspension. Immerse in a constant-temperature water bath and set the time timer going. Immerse the hydrometer and take readings at 1, 2, 3, 4, 5, 7, 10, 15, 20, 30, 45, 60, 120, and 180 minutes. The hydrometer used is a Taylor Permax (range 1.000 to 1.050). The particle-size distribution is calculated from the following formulas and the results are plotted on semi-log paper:

$$r^2 = 9/2 \times \frac{hn}{(d_1 - d_2)60gt}$$

r = radius of spherical particle (microns).
n = viscosity of medium (poises).
h = effective depth of hydrometer.
d_1 = density of talc.
d_2 = density of medium.
g = gravity acceleration (cm./sec.²).
t = settling time (min.).

$$W \text{ per cent} = \frac{S}{S-1} \times \frac{100}{C}(R - d) \times 10^3.$$

W = weight per cent finer than indicated size.
S = density of talc.
C = concentration of talc (gm./liter).
R = hydrometer reading.
d = correction factor for temperature changes, etc.

This method is quite simple and is accurate to 0.50% for successive runs. The assumption, however, must be made that the particles are spherical, which is not the case, but the error from this factor is very small and for most work can be neglected. It will be noted that the foregoing method is preferred owing to its simplicity, but the Andreasen method may also be used.

(7) The following body was tentatively agreed upon for empirical testing of the talc:

Feldspar (67-41)	10%
Talc	90%
Cere Amic Flour	2%

NOTES: (*a*) United Feldspar & Minerals Corp., Spruce Pine, N. C., Spar No. 67-41, will be stock-piled and tested at the United Feldspar Corp. and shipped to the testing agencies under their direction.

(*b*) Cere Amic flour is obtained from the Illinois Cereal Mills, Paris, Ill.

(*c*) All materials will be predried at 180°F. before weighing.

The body will be ball-milled two hours, using a mill of approximately 2-qt. capacity and one-half the usual number of pebbles (mill one-quarter full of pebbles). After milling, 12% water plus or minus 1/2% will be added to the body in excess of 100% dry weight by hand kneading for 3 minutes. The thoroughly wetted mix will be forced through an 18-mesh screen, dried at 180°F., and the portion passing through 20-mesh and retained on 60-mesh will be used for pressing. Disks 1 1/8 inch in diameter and approximately 1/4 inch thick will be pressed, using 8.5 gm. of material and 4 tons per square inch. Those samples having a thickness greater or less than 5% from the average will be discarded. The green density (see paragraph 10), diameter, and thickness of these samples will be found.

(8) The rate of heating for firing will be approximately 540° per hour to 2200°F. and 60° per hour thereafter. Three draw trials of 5 samples each will be made at 25° intervals, so that the first draw trial will be removed before the vitrification point and the third above the vitrification point. The dense draw trial will be used for the following tests.

(9) The absorption of the samples used for shrinkage determination shall not be more than 0.05% when measured by A.S.T.M. Method D–116–42.

(10) The green and fired density shall be found by the method discussed by Speil and Wilson.*

(11) The diameter, height, and volume shrinkage will be determined.

(12) The color of the samples shall be noted.

* Sidney Speil and Hewitt Wilson, "An Improved Mercury Balance Volumeter," *Jour. Amer. Ceram. Soc.*, 25 [10] 275–77 (June 1, 1942).

. . . 47th Annual Meeting . . .
The American Ceramic Society, Inc.,
Hotel Statler, Buffalo, N. Y.,
April 15-19, inclusive, 1945

All Divisions Meeting Simultaneously
Fellows, Institute of Ceramic Engineers,
Ceramic Educational Council,
Ceramic Camera Club

NEW MEMBERS IN OCTOBER

Corporation

ASSOCIATED ENGINEERS, INC., Paul Mankin (voter), Old First Bank Bldg., Fort Wayne, Ind.
STEUBENVILLE POTTERY CO., W. J. Mould (voter), Steubenville, Ohio.
*VOLLRATH COMPANY, J. C. Vollrath (voter), 18th and Michigan Aves., Sheboygan, Wis.

Personal

ARWINE, ALVA S., R. D. 2, Norristown, Pa.; Refractory and Insulation Corp.
BLOCH, JOSEPH, J. Bloch & Sons, 157 Spring St., New York, N. Y.
BRAUN, JULIUS, 300 N. Canal St., Chicago 6, Ill.; Glass Crafters.
GILES, KENNETH B., 1327 Blue Ave., Zanesville, Ohio; Roseville Pottery, Inc.
GREEN, RICHARD V., Hawaiian Crafts, Inc., Paducah, Ky.; general manager.
GUTHRIE, GEORGE B., 435 W. Martin St., East Palestine, Ohio; superintendent, W. S. George Pottery Co.
LUND, EVELYN C., 1006 Pasadena Dr., Fort Wayne 6, Ind.; studio potter.
*MANSUR, HOWARD, 151 S. Washington St., Spokane 8, Wash.; production manager, Washington Brick & Lime Co.
MARTIN, JOHN R., 1125 W. Mistletoe Ave., San Antonio, Texas; leasing and selling industrial clays to mills.
MULLADY, RUSSELL E., 1006 College Ave., Niagara Falls, N. Y.; ceramic engineer, Titanium Alloy Mfg. Co.
PAVLIUCHENKO, V. I., Soviet Purchasing Commission, 210 Madison Ave., New York, N. Y.
RUST, ELLSWORTH M., 902 Denrike Bldg., 1010 Vermont Ave., N. W., Washington 5, D. C.; president, Woodbridge Clay Products Co.
STOTT, A. E., Edward Johns & Co., Ltd., Armitage, nr. Rugeley, Staffordshire, England; director.
THOMPSON, D. A., Titanium Alloy Mfg. Co., Niagara Falls, N. Y.; assistant general manager.
THORNGATE, BRUCE W., Box 2614, University Sta., Gainesville, Fla.
WELLECH, EDMUND H., 75 W. Fifth St., Corning, N. Y.
ZWERDLING, EDWARD, 648 W. McCoed, Neosho, Mo.

* Indicates former member of The Society rejoining.

MEMBERSHIP WORKERS' RECORD

CORPORATION: E. M. Hommel 1, F. A. Petersen 1, Office 1.
PERSONAL: G. D. Brush 2, L. C. Hewitt 1, G. H. Krause 1, R. Newcomb, Jr. 1, F. K. Pence 1, R. Russell, Jr. 3, L. R. Whitaker 1, Office 7.
GRAND TOTAL: 20.

ROSTER CHANGES IN OCTOBER*

Personal

CZOLGOS, EDMUND P., 4155 East 71st Street, Cleveland, Ohio (Chicago, Ill.)
GIBSON, KENNETH A., 230 Washington Ave., Charleroi, Pa. (Corning, N. Y.)
HARTMAN, F. HENRY, 150 Calais St., Arvida, Quebec, Canada (Winnipeg, Manitoba, Canada)
KING, WALTER F., 13 Haslach Ave., Trenton 9, N. J. (Philadelphia, Pa.)
KUNZMAN, E. E., Orefraction, Inc., 7505 Meade St., Pittsburgh 8, Pa. (Niagara Falls, N. Y.)
MERRIAM, JACK G., 3437 Detroit Ave., Toledo 10, Ohio (Lewiston, N. Y.)
ROGERS, THOMAS S., 3720 Windom Place, N. W., Washington, D. C. (Chicago, Ill.)

* Address in parentheses is former address.

MEMBERS IN SERVICE*

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(377) EARL T. MIDDLESWARTH, Corning Glass Works, Corning, N. Y.
(378) CPL. OWEN J. REYNOLDS, Camp Pickett, Va.
(379) MURRAY A. SCHWARTZ, Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. Y.

* These are in addition to the lists published monthly, beginning with the September, 1942, *Bulletin*, with the exception of the June, 1943, issue.

★ LETTERS FROM SERVICEMEN ★

The American Ceramic Society inaugurated a Letter to Servicemen in August. This letter was intended to bring them some recent information of the ceramic industry. It is rewritten from material published in *The Bulletin*, *Ceramic Abstracts*, and *The Journal* and goes to about four hundred members, former members, and ceramic students in the service.

Favorable replies from all corners of the world are starting to come in. A few are printed here. You will be interested in what these men think of the ceramic industry when they are far away from it.

Pyote, Texas,
26 September, 1944

Dear Dr. Purdy:

It has been a long time since I have had any dealings with ceramics. Since I graduated from Penn State in December, 1942, I have not been a member of The Society. Will you please send me full particulars as to how I could rejoin. I would like to receive your publications again and, if possible, purchase written material you have published since January, 1943.

I entered the service in May, 1943, and received training at Boca Raton, Fla.; Yale University; Boeing Plant, Seattle, Wash.; Lowry Field, Denver, Colo.; and finally here. I am a Flight Engineer on a B-29. We train and instruct combat crews for overseas duty. I miss the study of ceramics, but I believe the training I have had in the Army in the fields of mechanics, electricity, electronics, etc., is priceless. Some of the schools I have attended are excellent. I sincerely believe informality will prevail in college classrooms after the war, because boys returning will not stand for formality.

Sincerely yours,
THOMAS J. BUTCHKO,
Lieutenant, A.A.F.

★

3623 S. Taylor St.,
Arlington, Va.,
21 September, 1944

Dear Dr. Purdy:

I have received and read with considerable interest the August 31, 1944, issue of "Ceramics for Servicemen."

Thanks for sending this to me. Unfortunately I have lost practically all contact with ceramics since leaving Drakenfeld in February, 1942, for duty in the Army. Some day I hope to renew all acquaintances and meet the new ceramists developed since my "time."

My Army life has been quite varied and equally interesting. There have been a number of trips, including four times across our country, up and down the West Coast, and a six weeks' stay in Hawaii. It has all been a good education for me. The war, however, can end none too soon to suit me and allow all of us to return to our peacetime pursuits.

Thanks again for the news and I hope to hear from you again soon.

Sincerely,
ORVILLE O. KENWORTHY,
Major C.W.S.

★

Herington, Kans.,
7 October, 1944

Dear Sir:

I was certainly pleased to receive the "Ceramics for Servicemen" from your office, although it had some trouble catching up with me. I get very little contact with ceramics in my Army duties and the extracts do "bridge the gap" somewhat.

I am leaving soon for overseas, but any correspondence addressed as above will be forwarded to me.

Sincerely yours,
LEONARD N. LARSON,
First Lieutenant, A.A.F.

★

Somewhere in France,
4 October, 1944

Dear Dr. Purdy:

After some little delay, I received your Ceramic News Letter of August 31 a few days ago. I was indeed pleased to receive it and to read the news brief contained therein. It's good to know that we haven't been forgotten by The Society—especially those of us who are really "youngsters" in the organization.

We all look forward with great anticipation to the resumption of our quest for fame and fortune in the field of ceramics. But that must wait until this unpleasant task before us is finished—we hope soon.

It is good to hear that The Society is growing in spite of the war. It should *really* grow when the war ends. I have been noting, rather *had* been noting while I was still in the States, a few of the publicized new uses for ceramic materials. It should be interesting to watch their appearance on the market—and perhaps to have a small hand in developing others.

Thanks again for the letter. I will be glad to hear from you again.

Sincerely,
R. ALLAN THORNTON, JR.,
First Lieutenant, U. S. A.

★

Hollywood, Fla.,
9 October, 1944

Sir:

Thanks very much for your informative letters to us in the services; many of us *are* looking to the ceramic industry in our postwar planning and welcome news of its activities.

Many of us, too, would appreciate the working out of some sort of plan whereby those of us who have gone into the services directly from the senior year of engineering school (and intend to return for graduate work when the war is won) may continue as Student Members in The Society. We are not drawing professional salaries from the industry, and feel that a full professional membership in The Society is too heavy a load. On the other hand, we would like to keep abreast of the ceramic field through *The Journal* and *The Bulletin* and maintain Society membership.

The objection to physical chemistry as a requirement for the ceramic engineer was well answered by the CEC Committee. Students see no use for P-Chem because the instructional force in their home department fails to tie the subject into the basic ceramic courses.

Sincerely,
KARL E. KRILL,
Lieutenant, U.S.N.

★

El Paso, Texas,
12 October, 1944

Dear Dr. Purdy:

Your round-robin letter "to ceramists in the services" dated 26 September reached me today.

I want to take this opportunity to thank you for it and to express my appreciation for a newsy letter of the activities of The Society and the industry. It is a very commendable undertaking on your part and I'm sure greatly appreciated for I imagine that many of us in service have missed a lot that is and has gone on in our profession.

With kindest personal regards, I remain

Sincerely yours,
W. W. KRIEGEL,
Major C.H.C.

★

College Station, Texas,
2 October, 1944

Dear Sir:

You don't know me, and with good reason, for I am a very small part of The American Ceramic Society. I completed two years in the ceramic engineering curriculum at Virginia Polytechnic Institute before coming into the Air Corps as an aviation cadet. All through my studies at V.P.I. the desire to be somebody, to make a place for myself in the ceramic industry, grew stronger every day and was fostered by my association with Professors Whittemore and Dear. Naturally, one loses a little of the enthusiasm he has held once the rigid aircrew training is under way and the Army supersedes the college lab. My determination to go back to college and finish has been greatly strengthened, however, by the frequent letters which you have sent me throughout my training. I want you to know how much I appreciate your consideration in keeping me up to date on the happenings within the ceramic industry.

My own personal yen is toward the fields of glass and structural clay products, and I imagine my junior and senior years will find me choosing between the two.

In closing, I'd like to say that, in my own humble opinion, the ceramic engineering graduates of Virginia Polytechnic Institute owe much to Professor J. W. Whittemore and Professor Paul Dear. They are two of the grandest men I've ever met, and I have oftened wondered if there is anything in the world they don't know about, in the line of ceramics. They are the biggest reason I'm going back to V.P.I. It's an honor and a privilege to work with them, but I'll never tell'em so because things like that are better left unsaid between a student and his professor. When I'm a production man for Owens-Illinois, I'll come back and tell them!!

I've deviated from the subject a little, but all I've said is connected up with that degree of ceramic engineering. Some day, I'll thank you personally for keeping my interest and determination alive.

Very sincerely yours,
ROBERT W. CROWELL,
Aviation Cadet, A.A.F.

★

Pemco Corp.,
Baltimore, Md.,
9 October, 1944

Gentlemen:

Regarding your questions as to what The American Ceramic Society can do for the men returning from service, it pleases me no end to have an opportunity to get my two cents' worth in.

One of the first things that I would suggest that The Society do is compile a list of the available positions. Once these positions are catalogued, the information should be made immediately available to the men upon returning. All of the work you could ever do on compiling such a list is going to be to no avail unless the men who want to take advantage of such opportunities know about them. It would possibly be best to advertise the fact that such a program is in progress perhaps by direct mail to the various members and even to the nonmembers of The Society who are interested in ceramics and are qualified to accept such jobs as are available.

I have an idea that there are a number of men in service today who, just before entering the service, were inclined to think pretty seriously about changing jobs but who, at the time, could not quite make up their minds that it was the thing to do. Now, upon return from service, they have an excellent opportunity to accomplish this.

That takes care of two groups: the group which has no job to come back to and the group which was planning on changing jobs before entering the service, but postponed it until sometime later. The third group of men consists of those who had just completed their studies in ceramics at universities before entering the service and have had no chance whatever to establish contacts in the ndustry for even a first job. These men could be ieached through the department heads in the various rniversities sponsoring courses in ceramics.

The American Ceramic Society might undertake to publish some form of consolidation of the developments that have taken place in the ceramic industry in the past three or four years, during which time these boys have been away. I know that in my own case I felt lost to a large extent after having been out of contact with the industry for so long.

The third project which might be undertaken by The American Ceramic Society is the promotion of fellowships in ceramics in the universities throughout the country. In my own case again, upon returning, I felt that I needed nothing more than a refresher course at a university to bring me up to date. It was my belief at that time that the best means by which I could do this was to return to school for postgraduate work on a fellowship. Fortunately, or unfortunately, as the case may be, I did not do so. Perhaps some day I may wish that I had. It seems to me that The Society is in a position to encourage the various organizations throughout the ceramic industry to sponsor such fellowships, and I believe possibly that The Society could act as a clearing house for these fellowships.

If I am not mistaken, most of the universities are planning some sort of postwar refresher course for those men who desire to take it. But I do not believe that alone is sufficient. There is always a matter of expense that a man returning to school will have to consider. It is my understanding that such refresher courses as are planned would count in no way toward obtaining an additional degree, whereas the work done in connection with a fellowship would. That degree is, by the way, a mighty powerful incentive.

These are a few of the ideas that have occurred to me. I hope that these opinions may be of some value to you and I am surely grateful for the opportunity to have presented them.

—JAMES B. WILLIS

Captain Willis has returned to the Pemco Corporation after nearly four years of active service in the United States, New Guinea, and Australia.

★

New York, N. Y.,
5 October, 1944

Dear Sir:

Just a note to express my appreciation for your Ceramic News Letter for Servicemen which I have just received. I have not been able to read The Society publications as I am having them sent to my home address, and this helps a lot.

As I went directly into the Army from school, I have had no opportunities to establish contacts in the ceramic industry. It is therefore comforting to know that peace should bring a boom to the industry and probably create plenty of jobs in this field. I hope The Society, however, will perhaps have a form of Directory Service which might help us, as returning servicemen, to find jobs in the field.

Sincerely,
CLARENCE A. LAMBELET,
Lieutenant, U.S.A.

EDITORIAL BY PRESIDENT EDWIN H. FRITZ

OUR CERAMIC SCHOOLS

The importance of our ceramic schools cannot be overemphasized. Although private research and production developments are responsible for much of our ceramic progress, back of it all we must credit the ceramic schools with the foundation which has made all of this possible. They have developed and expanded the interest in ceramic education and thus provided the talent and ability which has made possible the organizations, groups, and individuals who are so largely responsible for our progress in ceramic technology and production. It is important, therefore, that the schools receive our constant cooperation and support, because only with this help can the schools insure a continuation of their fine work and accomplishments so far.

Our support can be in several directions. First of all, we should help to provide them with students. Opportunities frequently arise to interest promising young men in a ceramic education. These should not be missed. Speaking to groups of high-school students is also worth while, even though results are often not apparent, because it at least widens public knowledge of ceramic education, which will in time accomplish the same result. It is, of course, realized that at the moment there is little opportunity for this type of support, but we should be sure to provide it in the postwar period when so many of our boys will be interested in a higher education.

Another very important form of support is to keep our ceramic educators intimately informed of the needs of the industry, particularly as these needs change with new developments and changing products. A survey made of our ceramic industries by the Institute of Ceramic Engineers a few years ago indicated some very definite and important items which the industries felt were not too well taken care of by the ceramic schools in their courses of instruction. This information was obtained by means of a questionnaire directed to a large number of industries. Information of this kind should be constantly flowing to the schools and this is the responsibility of each and every industry. New and improved practices and procedures often have an important bearing on courses of instruction, and if the schools are promptly informed, the students will be abreast of such developments. It is not expected that individual industries maintain contact with all ceramic schools. If they will only do this with the school in their immediate territory, the result will undoubtedly be achieved.

The industries should also keep their plants available to the schools and ceramic educators at all times. Unquestionably, periodic visits by the educators to representative plants to see what is going on will accomplish more than anything else, provided the plants will open up with the educators on such visits. It is here where the educators have an important responsibility. They should make such visits even though the plants do not believe they have anything new to show. They will note things of interest and of value which often do not occur to the men in the plant. This is particularly important at this time when the schools should be preparing for the postwar period when they undoubtedly will have more students than ever before. The war has brought about many changes and improvements which will affect practically every ceramic product. Unless the educators use the present period when enrollments are low to become informed of these and to discuss with the industry postwar needs for engineers and technologists, they will not be in a position to properly prepare their students to be most effective when they finish their schooling. Undoubtedly, individual courses should be revamped, new ones added, and some eliminated and these changes should be worked out at the present time. The educators can well afford to critically review all of their courses after having contacted numerous plants and decide whether these courses as now constituted really fill a need and, if so, whether they do it properly and completely.

The Society has always recognized the great importance of the ceramic schools in connection with its objectives. It, therefore, constantly encourages close cooperation between the schools and the industry in its programs and all of its activities. It offers an excellent opportunity for contact between the educators and the men in the industry and both should take advantage of this. Educators should know at least their nearest industries and the men in it and the industry men should make it their business to know the men in the schools. This will lead to the more intimate relationship by means of which educators can keep themselves fully informed. The Society, therefore, plays an important part and with its continued cooperation the way is open for the schools to supply the vital assistance which is needed to enable the industry to continue its advances and to maintain and improve its position in the postwar period. To accomplish this is probably a task of greater magnitude than we have ever faced before. We must make certain that our ceramic schools are prepared to take care of their part in the solution of the postwar problems.

REHABILITATION COMMITTEE OF THE STRUCTURAL CLAY PRODUCTS DIVISION

Chairman R. L. Stone has announced the organization of a Rehabilitation Committee in the Structural Clay Products Division.

This Committee will work with the Post-War Planning Board and the Veteran's Administration in developing a program for training war veterans as bricklayers and structural products builders. There is quite a division of opinion in regard to the adequacy of the supply of bricklayers for postwar building needs. The labor unions express one view, whereas the building organizations and others state that there will be a deficiency of skilled bricklayers. One of the functions of this Committee, therefore, will be to determine the exact need of bricklayers in the various parts of the country and then to promote the idea of training bricklayers if there appears to be a deficiency.

Members of the Committee are as follows:

B. T. Bonnot, *Chairman*, Bonnot Co., Canton, Ohio.
H. C. Plummer, Structural Clay Products Institute, 1756 K St., N. W., Washington 6, D. C.
L. R. Whitaker, Carolina Ceramics, Inc., Box 1257, Columbia, S. C.
J. H. Isenhour, Isenhour Brick & Tile Co., Salisbury, N. C.

(1944)

"GLASS THROUGH TIME" EXHIBIT AT BALTIMORE MUSEUM OF ART

Five hundred pieces of glass, ranging in size from miniature flasks to large modern glass sculptures, are being shown at the first fall exhibition at the Baltimore Museum of Art, Baltimore, Md. The exhibit opened October 6 and will close November 19.

Entitled "Glass Through Time," the exhibit is the first of its kind to be shown in Baltimore. It includes displays by Baltimore glass manufacturers and loans from local glass collections.

One hundred and fifty pieces from early French and Italian periods, a recent gift to the Museum from Mrs. W. W. Crocker, Burlingame, Calif., are being shown for the first time. Collections of Egyptian and Roman glass have been loaned by the Walters Art Gallery and the Johns Hopkins University.

The Maryland Historical Society has contributed a collection of Bohemian glass, and a group of Syrian glass pieces has been assembled from out-of-town collections. A large representative showing of early American, Stiegel, Amelung, Sandwich, and Jersey glass is being displayed separately.

WHAT SHALL I TELL THE CERAMIST WHEN I ASK HIM TO JOIN THE SOCIETY?

1. Tell him that The American Ceramic Society brings the technical brains of the industry to his mail-box in The Society publications (show him the *Journal*, *Ceramic Abstracts*, and *Bulletin*).

2. Tell him that The American Ceramic Society brings the scientists and executives to the spring and autumn meetings to answer *his* questions and discuss *his* problems.

3. Tell him that The American Ceramic Society, through its technical committees and through its central organization, represents *his* interests in governmental, in scholastic, in standardizing, and in regulatory organizations and protects *his* interests before such bodies.

Tell him this—then ask him to join The Society.

PAID MEMBERSHIP AND SUBSCRIPTION RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
October 21, 1943	2043	302	6	501	220	3072
January 21, 1944	2110	323	4	531	220	3188
February 21, 1944	2147	330	4	540	220	3241
September 21, 1944	2246	389	2	601	220	3458
October 21, 1944	2261	393	3	605	220	3482
12-month % increase	10.7	30.1		20.8		13.34

NORTHERN OHIO SECTION

Officers of the newly formed Northern Ohio Section are as follows:

Chairman: EDWARD M. SARRAF, Harbison-Walker Refractories Co., 1505 Rockefeller Bldg., Cleveland 13, Ohio.
Secretary: STEPHEN M. SWAIN, North American Refractories Co., National City Bank Bldg., Cleveland 14, Ohio.

Representatives to Cleveland Technical Societies Council

To Board of Governors: EDWARD SARRAF; *Alternate:* J. E. HANSEN, Ferro Enamel Corp., 4150 East 56th St., Cleveland 5, Ohio.
To Program Coordination Committee: BENJAMIN J. SWEO, Ferro Enamel Corp., 4150 East 56th St., Cleveland 5, Ohio.
To Publication Committee: GERALD E. REINKER, General Electric Co., Glass Technology Laboratory, 1133 East 152d St., Cleveland, Ohio.

ST. LOUIS SECTION

The St. Louis Section met with the Engineers' Club of St. Louis October 5, 1944. The meeting was held in the clubrooms of the Engineers' Club.

J. C. Hostetter, president of the Mississippi Glass Co., St. Louis, was the speaker of the evening. He described the recent research and developments in the glass industry that have resulted in changing the old conception of glass from a "hard, transparent, brittle substance" to an engineering material of many uses in widely diversified fields. He discussed some of the uses of glass in the war effort and illustrated them by samples and lantern slides.

PITTSBURGH SECTION

The first fall meeting of the Pittsburgh Section was held in the Mellon Institute auditorium Tuesday, October 10, at 8:30 P.M., with Vice-Chairman Harold Simpson presiding. Some sixty members and guests attended.

Frank M. Cashin of the Permanente Metals Corporation gave a short résumé of the history of the Permanente plants and process as a background for the thirty-minute technicolor narrated film, "Permanente Magnesium, the Magic Metal for War and Peace." This very interesting picture portraying the activities of the Permanente Company in California as sole producer of magnesium by the "carbothermic" process began with the mining and processing of dolomite. Reaction of the calcined dolomite with sea water was followed by separation and concentration of the high-purity periclase which after calcination was reduced with petroleum coke in an inert atmosphere. The crude magnesium was distilled to effect purification to the 99.9+% stage. From condensers it went to the foundry for alloying and casting into numerous items requiring the combination of light weight and strength, especially in the fabrication of today's warplanes.

Following the film, the speaker discussed products and by-products of the Permanente Corporation's manufacturing processes with special emphasis on materials of interest to the ceramic industry. Periclase is the principal product of the sea-water treatment of the calcined dolomite and is used in making a magnesite brick which shows considerable promise for west coast markets. A siliceous by-product of the Company's ferroalloy plant is a dust obtained by means of smoke-collecting equipment. This is 96 to 97% silica, light gray to white, with an average particle size in the millimicron range. Present uses are found in the rubber and abrasives fields.

An informative discussion followed Mr. Cashin's talk.

The next meeting was held Thursday, October 26, at 8:00 P.M. in the Mellon Institute auditorium in conjunction with the American Society for Testing Materials. Speakers for the evening were P. H. Bates of the National Bureau of Standards, who discussed Portland cement, and F. C. Flint of the Hazel-Atlas Glass Company, who summarized the development of glass as an art and as a science.

—J. W. JORDAN, *Secretary*

CERAMIC SOCIETY OF THE SOUTHWEST

The fifth regular meeting of the Ceramic Society of the Southwest was held at the University of Texas, Austin, Texas, October 6 and 7.

The president, Frank Mahurin, Alamo Clay Products, San Antonio, Texas, presided.

The first session was called to order at 2:30 P.M. After the transaction of current business, the following papers were presented:

(1) "Facing Tile—Looking Forward" by NEILL BOLDRICK, Acme Brick Co., Ft. Worth, Texas.

(2) "Power Costs" by CHARLES C. LAKE, Marshall Brick Co., Marshall, Texas.

(3) "Texas Raw Materials" by E. A. EKDAHL, Texas Electric Service, Ft. Worth, Texas.

A great deal of interesting discussion followed the presentation of each paper.

The president recognized the presence of J. E. Fender, national president of the Structural Clay Products Institute. Mr. Fender presented a discourse on the subject of the all-masonry house. Mr. Fender has been actively identified with the promotion of this type of construction, which is rapidly gaining popularity.

The session of October 7 was called to order at 9:30 A.M. The following formal papers were presented:

(1) "Tunnel-Kiln Design and Operation" by MARSHALL T. CHURCH, Alamo Pottery Co., San Antonio, Texas.

(2) "Fundamental Relation of Design and Materials" by EDWIN PEARSON, San Jose Pottery Co., San Antonio, Texas.

(3) "Product Design" by KENNETH E. SMITH, Sophie Newcomb College, New Orleans, La.

(4) "Tableware Manufacture" by ROBERTO C. SADA, Keramos, S. A., Monterrey, Mexico.

Informal talks were also given by J. E. Fender, Tom Butler, Sr., Loren Mozley, E. P. Schoch, A. B. Cox, and W. R. Woolrich.

The predominating theme of the discussions were to the effect that (1) ceramic development belonged in the field of small business, (2) the survival of small business is essential to the national welfare, (3) the policy of state aid in research investigation for the benefit of small business is justified, and (4) the State of Texas should establish a Ceramic Department and an Institute of Ceramic Research at the University of Texas at the earliest possible date. Suitable resolutions were adopted in support of this recommendation.

The interest as manifested both in the discussions and in the number in attendance again set a new high mark.

The next meeting of the Society will be held in Austin sometime during March, 1945.

—F. K. PENCE, *Secretary-Treasurer*

CHICAGO DISTRICT ENAMELERS' CLUB

The first fall meeting of the Chicago District Enamelers' Club was held September 23 at the Graemere Hotel, Chicago, Ill.

The following program was presented:

(1) "Postwar Possibilities and Their Effect on Enamel Shop Operation" by EDWARD MACKASEK, Managing Director, Porcelain Enamel Institute, Washington, D. C.

(2) "Change of Methods for the Future" by HARRIE PARKER, Wheeler Reflector.

(3) "Enameler's Goal" by GEORGE H. SPENCER-STRONG, Pemco Corp., Baltimore, Md.

THE AMERICAN CERAMIC SOCIETY, INC., DIVISIONAL MEMBERSHIP BREAKDOWN AUGUST 31, 1944

	Paid 1944		Paid 1943 (not paid 1944)		Paid 1942 (not paid 1943–1944)		Paid 1941 (not paid 1942–1944)	
	Personal	Corporation	Personal	Corporation	Personal	Corporation	Personal	Corporation
Design	83	7	2	0	8	0	6	0
Enamel	185	46	11	0	13	1	14	0
Glass	408	98	8	0	27	1	15	1
Materials and Equipment	151	46	7	0	8	0	8	0
Refractories	517	71	31	2	43	0	23	0
Structural Clay Products	137	24	4	0	12	1	8	0
White Wares	417	88	28	2	18	0	17	0
Professors	74	0	3	0	3	0	5	0
All Division	22	3	1	0	6	0	1	0
No Division	100	1	2	0	13	0	11	0

STUDY OF MEMBERSHIP CLASSIFICATION AND ANNUAL DUES

By Ralston Russell, Jr.

Chairman, Membership Committee

During the last Annual Meeting, the members of the Board of Trustees discussed the possibility of increasing Corporation dues as a means to provide more revenue for operation of The Society. One suggestion was made that Corporation dues be raised from $25 to $100 annually. No decision was reached during the discussion and shortly thereafter President E. H. Fritz, as directed by the Board, requested the Membership Committee to make a study of the problem and report any findings at a later meeting of the Board of Trustees.

Any change in Society dues must be considered in four aspects:

(1) The *financial needs* of The Society.

(2) The *services* which The Society offers to its members and for the general welfare of the entire ceramic industry.

(3) The effect of any change in dues upon the current and prospective *total membership* of The Society and upon the opportunities of The Society to serve in its fullest capacity.

(4) An equitable and satisfactory *dues structure*, as considered from the viewpoints of both the members and those charged with the responsibility for sound operation of The Society and administration of its affairs.

All of these aspects are closely interrelated and must in the final analysis be considered in a complementary manner. The first aspect, i.e., the financial needs of The Society, falls within the jurisdiction of the Finance Committee and thus will not be considered further in this report. The second aspect, i.e., the services of The Society, is of general concern and would merit summation and clarification both for the current and prospective membership if any decision to increase dues is made. The officers of The Society, the Board of Trustees, and many of the members are already familiar with the useful functions which The Society is now fulfilling and with the continuing expansion in its services and its range of influence. Suffice it for the moment to state that the services of The Society will be maintained well ahead of the cost of these services to either Personal or Corporation members and that any increase in dues will be accompanied, insofar as is practical, with tangible evidence of increased service. This aspect will not be treated further in this report.

The third and fourth aspects, viz., the total membership of The Society and a revised dues structure, respectively, were the special assignments to the Membership Committee and will be considered in the remainder of this report.

At the outset, it was deemed desirable to determine the feelings of the Corporation members with respect to the proposed increase in Corporation dues. Accordingly, a letter and questionnaire were designed, and, with the help of The Society's office staff, were prepared and mailed to the total Corporation membership of approximately 350. Over a period of several months, 160 replies were received, many of which not only answered the specific questions but offered constructive suggestions. In addition to a study of these replies, the writer investigated in a general way the dues structure of comparable scientific and technical organizations. Following the initial analysis, a report was made to all members of the Membership Committee, along with an invitation to offer comments and to present a tentative plan for consideration of the other members of the Committee and eventually the Board of Trustees. This attempt at cooperative Committee functioning was not very successful. The following analysis, therefore, is not necessarily representative of the viewpoints of all members of the Membership Committee, but is based largely upon a general study made by the writer, with invaluable help from all those who returned questionnaires and those who wrote letters and comments to describe their views more fully.

The analysis of the three questions comprising the questionnaire may prove to be enlightening:

(1) Do you favor the expansion and extension of the services of The American Ceramic Society (as per letter accompanying the questionnaire)?

Yes	103
No	14
Undecided	11
No Answer	32
	160

The general attitude of the members is favorable to expansion and increased service within reasonable limits. A few were opposed to any attempt to extend the services of The Society, but in practically all cases the reason cited was that the members in question were receiving as much service as they required. Those who reserved judgment on the question of expansion and extension did so largely because the proposed extension was not outlined in a manner to permit final judgment. It can be assumed that a high percentage of the Corporation members favor increased service if it can be provided at a reasonable cost.

(2) Do you feel that a minimum Corporation sustaining fee of $100 annually would be unreasonably high? If the answer is "Yes," please indicate reasons.

No	56
Yes	88
Questionable	16
	160

(3) Would your company probably continue its support of The Society at an increased minimum sustaining fee of $100 annually?

Yes	63
Probably	24
No	35
Questionable	38
	160

An analysis of the comments received with the answers to the questionnaire may be of interest. This analysis is necessarily general in nature. The number in parentheses following each comment indicates the number of separate comments of like nature.

(1) $100 annual dues would cause many corporations to discontinue membership. (19)

(2) A $100 fee is too high for small companies, for many equipment or material producers, or for supporting companies which have many nonceramic interests. (19)

(3) $50 annual dues would be much more reasonable, would represent a more normal increase in dues, and would maintain a larger membership than would $100 dues. (19)

(4) $100 dues might be acceptable at the present time, but in the postwar period may be unreasonably high. Such an increase, therefore, is not justified from a long-range viewpoint. (13)

(5) The services of The Society are already adequate at the present rate of $25 annually. (10)

(6) Any increase in dues, particularly to as high as $100, must be accompanied by tangible and specific evidence of increased service. (9)

(7) The amount of annual dues should be based upon the size and interests of a corporation. (9)

(8) The present time is not opportune for any wholesale increase in Corporation dues. (9)

(9) $100 dues are too high for those services of The Society which are of use (to specific corporations). (9)

(10) Any increase in dues should be accompanied by added privileges such as, for example:

(*a*) Granting of admission of all employees of Corporation members to Society meetings.

(*b*) Additional free subscriptions to The Society's publications.

(*c*) Additional personal and voting members with each Corporation membership.

(*d*) Reduced personal membership dues for any employee of a Corporation member. (5)

(11) Several classes of Corporation membership having variable dues should be established. (4)

(12) It is more desirable to have a higher number of members at a lower fee than a markedly lower number at a high rate. The proper balance must be achieved. (4)

(13) The ceramic industry comprises so many small companies that Corporation dues of $100 are unreasonably high. (3)

(14) An increase in Corporation dues to $100 would cause some companies to revert to personal membership. (3)

(15) It is objectionable to raise Corporation dues during a period of such intense membership solicitation. Some guarantee should be given to all new members that their dues will not be increased until they have been members for a prescribed period. (3)

(16) The personal members should carry the main financial burden of The Society. (3)

(17) If Corporation dues are increased, those member companies who also finance several personal memberships will discontinue this latter support. (1)

(18) Any decision regarding Corporation dues should be made by Corporation members and not by any committee or the Board of Trustees. (1)

(19) Members should be advised more frequently and in greater detail as to how The Society is functioning for them. (1)

(20) To reduce operating costs of The Society and thus avoid an increase in dues, *The Journal* and *Bulletin* should be combined, the general contents should be condensed, and less history should be included. (1)

(21) The advertising rates in *The Bulletin* are unusually low and should be increased to provide additional revenue. (1)

The foregoing comments were offered incidentally to the questionnaire, and thus the final analysis must give due consideration to the specific questionnaire answers as previously summarized. It is important, moreover, to recognize that approximately half of the Corporation members did not return the questionnaire or provide any information whatever. What the general opinion of this group may be is largely a matter of conjecture, but it is logical to assume that the average feeling is one of indifference or indecision, as those with definite feelings would be more likely to reply.

It may be apropos, prior to the suggestion of a new dues schedule, to consider the plans prevailing in several comparable organizations:[1]

(*1*) *American Chemical Society*

Personal Member	$ 9.00
Corporation Member	25.00

Membership includes *Chemical & Engineering News* free and reduced rates for other publications.

(*2*) *American Institute of Electrical Engineers*

	Entrance Fee	Dues
Fellow Member	$20.00	$20.00
Active Member	15.00	15.00
Associate Member	10.00	10.00

Electrical Engineering free to all members.

(*3*) *American Institute of Mining & Metallurgical Engineers*

	Entrance Fee	Dues
Active Member	$20.00	$15.00
Associate Member	20.00	15.00
Junior Member		10.00
Student Member		2.00

Mining & Metallurgy free to all members.

(*4*) *American Society of Civil Engineers*

	Entrance Fee	Resident Dues	Nonresident Dues
Active Member	$30.00	$25.00	$20.00
Associate Member	25.00	25.00	20.00
Affiliate Member	30.00	25.00	20.00
Junior Member	10.00	15.00	10.00
Fellow Member	One $250.00 payment.		

All publications free to members.

(*5*) *American Society of Mechanical Engineers*

	Initiation Fee	Dues
Fellow Member	$30.00	$25.00
Active Member	25.00	20.00
Associate Member	25.00	20.00
Junior Member	10.00	(10.00 to age 30) (15.00 to age 33) (20.00 above age 33)
Student Member		3.00

Publications and catalogue free to members.

[1] Handbook of Scientific and Technical Societies and Institutions of the United States and Canada, 4th ed., January, 1942. Bulletin No. 106 of the National Research Council, National Academy of Sciences, Washington, D. C.

(*6*) *American Society for Testing Materials*

	Entrance Fee	Dues
Active Member	$10.00	$ 15.00
Company Member	10.00	30.00
Junior Member	5.00	7.50
Student Member		1.50
Sustaining Member		100.00

Members receive choice of publications free.

(*7*) *American Institute of Chemical Engineers*

	Entrance Fee	Dues
Active Member	$20.00	$15.00
Associate Member	20.00	15.00
Junior Member	5.00	10.00

Transactions free to all members.

(*8*) *American Concrete Institute*

Active Member	$10.00
Contributing Member	50.00
Corporations, Firms, or Societies	20.00

Journal free to all members.

(*9*) *American Foundrymen's Association*

Personal Member	$15.00
Company Member	25.00
Personal Membership for Employees of Member Companies	8.00
Foreign Member	15.00
Apprentice and Student Member	4.00
Sustaining Member	50.00

Transactions free to members.

(*10*) *American Society for Metals*

Active Member	$10.00
Junior Member	10.00
Sustaining Member	10.00
Foreign Member	13.00

Transactions, Metal Progress, and publications free to all members.

(*11*) *American Welding Society*

Active Member	$ 15.00
Sustaining Member	100.00
Associate Member	10.00
Operating Member	5.00 in U.S. and Canada 10.00 in foreign countries
Student Member	2.50

Journal free to all members.

(*12*) *American Society of Heating & Ventilating Engineers*

Active Member	$18.00
Associate Member	18.00
Junior Member	10.00
Student Member	7.50

Publications free to all members.

(*13*) *Electrochemical Society*

	Entrance Fee	Dues
Active Member	$5.00	$10.00

Bulletin and *Transactions* at reduced rates to all members.

(*14*) *Institute of Radio Engineers*

	Entrance Fee	Dues
Fellow Member	$10.00	$10.00
Active Member	5.00	10.00
Associate Member	3.00	6.00
Junior Member	1.00	4.00
Student Member		3.00

Proceedings free to all members.

(*15*) *Mineralogical Society of America*

Active Member	$3.00
Subscriber	3.00
Fellow Member	5.00

American Mineralogist free to all members.

(*16*) *American Refractories Institute*

Active Company Member	$25.00 minimum, dues based on sales
Associate Member	$25.00

Technical Bulletins free to all members.

(*17*) *American Management Association*

Personal Member	$ 30.00
Company Member	$100.00 to $1500.00, according to number of publications desired

The foregoing indicates that a majority of scientific and technical societies do not provide Corporation membership status, and this is particularly true of those major societies most similar in purpose to The American Ceramic Society. There is, therefore, but little outside experience which The American Ceramic Society can draw upon in selecting an equitable dues schedule.

It is very apparent from the preceding schedule that most organizations provide several classes of membership, based upon age or experience. The American Ceramic Society provides no such favorable dues schedule to induce the younger and less experienced prospects to become members and continue membership as age, experience, and financial classifications change on prescribed schedules. A properly devised schedule would aid materially in maintaining the maximum number of members and sufficient revenue for sound operation. Although Corporation dues are the subject of this report, personal dues should be considered concomitantly in the development of any revised schedule of dues. Attention is thus directed to a previous report of the Membership Committee.[2]

To provide a basis for discussion, a revised membership schedule is hereby proposed. This proposal is the result of a study of all available information and represents the opinion of the writer rather than the joint decision of all members of the Membership Committee. The plan is in reality an expression of all those who cooperated in any way in developing the fund of information cited, albeit an individual interpretation.

MEMBERSHIP SCHEDULE FOR THE AMERICAN CERAMIC SOCIETY

	Annual Dues	Reduced Dues
Fellow Member	$ 20.00	$15.00
Active Member, Class 1	15.00	10.00
Active Member, Class 2	10.00	8.00
Active Member, Class 3	6.00	4.00
Student Member	2.00	
Sustaining Corporation Member	$100.00 min.	
Corporation Member, Class 1	50.00	

[2] R. Russell, Jr., "Report of Membership Committee to Board of Trustees," *Bull. Amer. Ceram. Soc.*, **23** [2] 44–45 (1944).

Corporation Member, Class 2	25.00
Honorary Member	No dues

NOTE: Reduced dues apply only to employees of Sustaining and Class 1 Corporation members.

DEFINITION OF CLASSIFICATION

Fellow Member: Any active member elected to fellowship status. Full voting and office-holding privileges.

Active Member, Class 1: Any active member after he reaches the age of 31. Full voting and office-holding privileges.

Active Member, Class 2: Any active member after he reaches the age of 26. Full voting and office-holding privileges.

Active Member, Class 3: Any active member under 26 years of age. Full voting and office-holding privileges.

Student Member: Any member pursuing a course of study at a recognized university. Student rating may be continued for one year following year of graduation. Full voting privileges. A student member shall not hold elective office unless he has been a member for five years.

Sustaining Corporation Member: Any member company which voluntarily elects to support The Society beyond the required stipend for Corporation Membership, Class 1. A sustaining membership carries one Corporation and Personal Membership, the privilege of two extra subscriptions to the publications, and special dues ratings for all employees. A Sustaining Corporation Member with several operating divisions may enroll each division as a Sustaining Member by payment of $10 annually per division. No extra charge is made for the first division so enrolled as it is included in the original Sustaining Corporation Membership.

Corporation Member, Class 1: Any member company directly engaged in the major production and/or sale of ceramic raw materials, processing equipment, or manufacture products, and whose volume of ceramic business is in excess of (——)* annually, and/or whose number of nonproductive and productive employees engaged in ceramic-related activity exceeds fifty. Each Class 1 Corporation Membership shall carry the privilege of one Corporation and Personal Membership, one extra subscription to the publications, and special dues ratings for all employees. A Corporation member, Class 1, with several operating divisions may enroll each division as a Corporation member, Class 1, by payment of $20 annually per division. No extra charge is made for the first division so enrolled, as it is included in the original Class 1 Corporation Membership.

Corporation Member, Class 2: Any member company or organization not rated as a Corporation member, Class 1. Any member of this class may voluntarily elect to become a Corporation member, Class 1, or a Sustaining Corporation member. Each Class 2 Corporation membership carries the privilege of one Personal membership.

Honorary Member: Any member so elected. Full voting and office-holding privileges.

A special board shall be detailed to determine the membership class of all Corporation members, based upon authenticated reports.

The age of a personal member shall be considered to be the highest age he attains in a given year. The age of a member shall be recorded at the initiation of the new schedule, or subsequently upon his joining The Society, and shall be used in all computations to determine membership class.

The special plan encompassing lower dues for employees of member companies is designed to provide an added inducement for companies to support The Society. Such a plan would also have the effect of offering more inducement to employees of member companies to join The Society. This would benefit the member employees, the companies, and The Society. The influence of the employees and companies would operate reciprocally to the welfare of The Society and the entire ceramic industry. Such a plan would seem to be very useful in all attempts to build The American Ceramic Society into the strongest possible organization.

The plan to provide several grades of personal membership has been discussed in detail previously, and attention is directed to the first report on this subject.[2] Such a plan has the special merit that it is designed to yield the greatest number of continuously sustaining active members. This is made possible through the establishment of a habit-forming, low-cost period during which the members become familiarized with the benefits and opportunities within The Society. The attitude of most other societies toward this system is ample evidence justifying its adoption.

It is further recommended that any new Corporation members be guaranteed membership for at least two years at the rate prevailing upon their affiliation with The Society. This will largely avoid any misunderstanding in case dues are increased.

There are many other details which must be considered in adopting any new membership classification schedule, but these can be worked out as they arise.

One should recognize that the foregoing proposal is not meant to be unequivocal. The proposed dues for various classes and the number of such classes are largely arbitrary. The dues schedule in particular may require some adjustment following a study made from the financial viewpoint. It is recommended that with this report as a foundation, attention be directed toward two aspects of this subject mentioned at the outset but not discussed in detail, viz., *Financial Needs* and *Services* of The Society.

* The proper "volume of business" figure for use has not yet been determined.

1944–1945 CERAMIC DATA BOOK ISSUED BY INDUSTRIAL PUBLICATIONS, INC.

The method of distribution of the Ceramic Data Book is unusual and comes under the definition of "controlled circulation." Industrial Publications, Inc., aims to see that each plant receives at least one copy, preferably the subscriber to *Ceramic Industry* or *Brick & Clay Record* in that plant, if there is a subscriber. Fortunately, they do have subscriptions from most plants. In the case of large plants, where there are separate divisions, such as the research division, technical division, manufacturing division, and executive, they send more than one copy. In that case, too, a preference is made among subscribers wherever possible. Thirdly, those plants that are actively engaged in an expansion or remodeling effort are covered.

As they have only 6000 copies, they must be very careful about their distribution. In exceptional cases, a charge of $1 a copy is made. As this book is chiefly an advertising catalog development, they endeavor to distribute it among those who have purchasing power. Last year, they could have distributed 9000 books if they had had them.

(1944)

PENNSYLVANIA SALT MANUFACTURING COMPANY

Dedication of Whitemarsh Research Laboratories

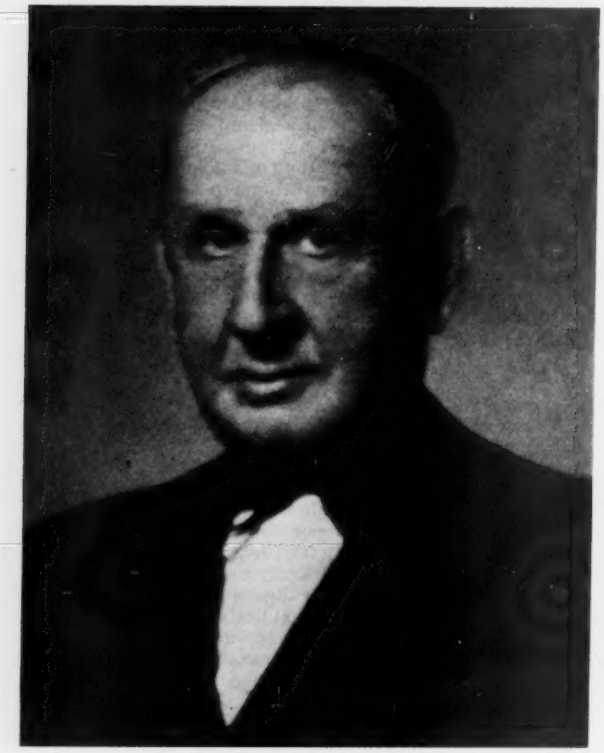
October 4 to 7, 1944, the Pennsylvania Salt Manufacturing Company formally opened their new Whitemarsh Research Laboratories at Chestnut Hill, Pa., near Philadelphia.*

The formal dedication was held October 4. Leonard T. Beale, president of the Company, presented the key of Whitemarsh to S. C. Ogburn, Jr., manager of the Research and Development Department. C. F. Kettering, general manager of the General Motors Corporation, Research Laboratory Division, gave a short address.

During the four days of the opening, groups from various fields of science, industry, and education were conducted through the new laboratories. The last day of the opening was reserved for Company employees.

* See *Bull. Amer. Ceram. Soc.*, **22** [12] 415 (1943) for a photograph and description of Whitemarsh Hall.

PERSONAL NOTES



Ignaz Kreidl

Dr. Kreidl will celebrate his seventy-fifth birthday December 11.

For notice, see October, 1944, *Bulletin*, pp. 393-94.

GORDON CAMPBELL KEITH

Gordon Campbell Keith celebrated the completion of thirty years as secretary of the Canadian Ceramic Society September 17, 1944.

Mr. Keith was presented with a life membership in the Canadian Ceramic Society in 1942 (see the December, 1942, *Bulletin*, p. 313). His biographical sketch and photograph appeared in the April, 1940, *Bulletin*, pp. 153–54.

The fall dinner meeting of the Canadian Ceramic Society will be held November 27 at the Engineers' Club, 350 Bay St., Toronto, Ontario. Dinner at 6:30 P.M. J. R. Boyle will speak on "Electronics in Industry."

REXFORD NEWCOMB

Rexford Newcomb, Chief of the Chemical Materials Branch, Conservation Division, War Production Board, Washington, D.C., on November 1 became associated with the Brickseal Refractory Co., Hoboken, N. J. He will remain in Washington until about February 1, 1945, working on details of federal specifications and military and Lend-Lease procurement of the Company's products, after which he will move to Pittsburgh to represent the Company as sales-service engineer in that area.

He has been with the War Production Board since its formation from the Office of Production Management in January, 1942, first as ceramic consultant, being promoted to head of the Chemical Materials Branch of the Conservation Division in August, 1944.

Before his association with WPB, he was for five years with Industrial Publications, Inc., Chicago, Ill., as managing editor of *Ceramic Industry* and associate editor of *Brick & Clay Record* and the Ceramic Data Book. Mr. Newcomb is a graduate of the University of Illinois, Class of 1936, with a B.S. degree in ceramic engineering.

A photograph of Mr. Newcomb and additional biographical data appeared in the August, 1938, *Bulletin*, pp. 343–44.

NECROLOGY

WILLIAM BAUSCH

William Bausch, chairman of the board of Bausch & Lomb Optical Company and last surviving son of John Jacob Bausch, founder of the Company, died at his summer home near Rochester, N. Y., October 19, 1944.

Mr. Bausch, who celebrated his eighty-third birthday last March 25, was a familiar and active figure in the research laboratories of the optical company until a few days before his death. His passing followed closely the death in July of his brother, Edward Bausch, formerly chairman of the board of the Company.*

Known to hundreds of employees as "Uncle Billy," Mr. Bausch had been with the Company for more than sixty-nine years and was widely renowned for his developments of optical glass, which grew out of experiments he began in 1903. He was responsible for the founding of the optical glassmaking plant at the Bausch & Lomb factory in 1915. It was this glass plant, the first of its kind in America, which saved the country from chaos when optical glass was no longer available from European sources in the first World War.†

During World War I approximately 425,000 pounds of optical glass were produced and incorporated in the range finders and other precision instruments produced by Bausch & Lomb for the military forces. The emancipation of this country from dependence on Europe for its optical glass has been of tremendous importance to the successful prosecution of the present war. Today this strategic material is no longer a problem. Since Pearl Harbor, this same glass plant, greatly enlarged with new furnaces and new buildings, has produced more than four million pounds of optical glass to meet the needs of the United States and her allies for this critical war material.

Born March 25, 1861, within a stone's throw of the plant on St. Paul Street, Mr. Bausch was educated in the Rochester public schools, Hale's Preparatory School, and the Collegiate Institute. He began his long career with the Company in 1875, sharing with his brothers, Edward and Henry, in the expansion of the Company's eyeglass business and the introduction of a line of scientific instruments beginning with the microscope.

Although active in every phase of the Company's business, Mr. Bausch's experimental work had occupied most of his time and resulted in the contribution of numerous patents and inventions, the last one being granted March 28, 1944.

Widely known for the affable, informal manner that won him a wide circle of friends, Mr. Bausch had an avid interest in people of all walks of life that was reflected in his entrance into the field of public services. He served terms as City Commissioner of Schools and as Commissioner of

* See *Bull. Amer. Ceram. Soc.*, **23** [9] 330 (1944).

† See also *ibid.*, **20** [2] 59–61 (1941).

Parks and received much of the credit for interesting the late George Eastman, a close friend, in founding the Rochester Dental Dispensary.

Mr. Bausch, Mr. Eastman, and the late Captain Henry Lomb followed the founding of the United States 'first free dental clinic by the Rochester Dental Society in 1901 by establishing a second clinic in old School 26. They continued to support that enterprise until the Rochester Dental Dispensary opened its doors in 1917. At the time of his death, Mr. Bausch still was serving as president of the dispensary and was a member of its board.

Mr. Bausch for more than a quarter of a century was chairman of the Annual Orphan Day outing and took personal delight in attending the event. A vice-president of the Hillside Children's Center for several years, he was actively interested in the Convalescent Home for Children, the Rochester Community and War Chest, and the Red Cross.

He was a trustee for more than twenty-five years of St. John's Home for the Aged and held memberships in the Rochester Museum Council, the Rochester Historical Society, the Optical Society of America, and the National Tuberculosis Association.

As a clubman, he was a founder and served as president of the Rochester Club for thirty-two consecutive years. The Genesee Valley Club, Oak Hill Country Club, Rochester Yacht Club, Country Club of Rochester, and Old Colony Club of New York City also listed him among their members. He was a 32d Degree Mason and received his fifty-year medal in 1943.

FRANK MATTHEW HARTFORD

Frank Matthew Hartford, a Fellow of The American Ceramic Society, died October 24, 1944, in São Paulo, Brazil.

Mr. Hartford was born August 29, 1897, in New Philadelphia, Ohio, and attended the New Philadelphia and Toronto (Ohio) schools. He attended the Ohio State University, Columbus, Ohio, but after three years his studies were interrupted by World War I.

He was employed by the Chelsea China Co., New Cumberland, W. Va., for a short time and then became associated with the Harrop Ceramic Service Co., Columbus, Ohio. He remained with this Company until 1933, when, with J. T. Robson, he organized the Allied Engineering Company in Cleveland, Ohio.

He went to South America in 1935 as a representative of this latter Company and also operated the Hartford Ceramic Company in Brazil and maintained interests in Argentina.

Mr. Hartford brought his family to the United States in June of this year and returned to São Paulo three weeks before his death.

He is survived by his widow, Mrs. Margaret Hartford, and one son, Thomas Hartford, a student at the Columbus Academy.

Because of war conditions, burial was held in São Paulo.

CERAMIC ASSOCIATION OF NEW JERSEY 1944 ANNUAL MEETING

The Ceramic Association of New Jersey will hold its 1944 Annual Meeting at the Ceramics Building, Rutgers University, New Brunswick, N. J., Friday, December 15. A well-rounded program of papers is being arranged for both the morning and afternoon sessions. A luncheon will be served at the local Roger Smith Hotel.

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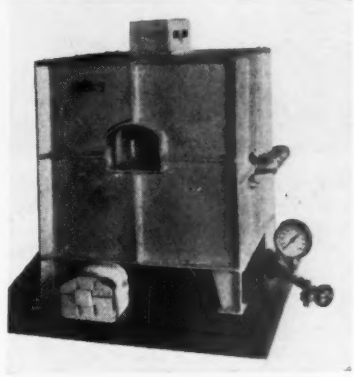

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LIEUTENANT MEYER AND TOM SHERWOOD*

By Frank W. Preston

The Price of Admiralty

Earth is poorer since last we met, and Heaven has gained distinguished citizens. For some we loved, the kindliest and best, have drunk their cup a round or two before. From the Pittsburgh district, at least two of our members have passed away within these last two months.

On July 2d, a great bomber crashed in a storm in Oklahoma. It was one of the B-29's, with whose development at Seattle and elsewhere Sam Meyer, Jr., had been closely associated for a couple of years. It was on a training flight by night, at 20,000 feet, when it seemingly ran into a thunderhead which ripped off one wing. There were no

Fig. 1.—Lieutenant S. B. Meyer, Jr. This photograph is the latest, having been taken just a few days before his death.

survivors, and details are lacking. Lieutenant Meyer's mangled body was shipped back to us; the heir-apparent of the Glenshaw Glass Company, and its best technologist, is gone.

He took his first degree within a few yards of our meeting place today, in the University of Pittsburgh, then went to Penn State to study under Nelson Taylor in glass technology, winning his Master's degree, and contributing a paper to this Society on opal glasses. He received several offers of research positions in high-ranking institutions of this country, but declined them one and all, as he made his plans to join the armed forces. He had more than usual difficulty in getting into a dangerous occupation, and even after he was accepted, it was many months before he was called. He used the time to improve significantly the technological performance of the Glenshaw plant, and came to Butler frequently, either to the lab, or to put in a little flying time at the Pittsburgh-Butler Airport, or both.

He discussed his career with me more than once, but it always wound up the same way. With a quiet smile, he would finish, "I should not feel I was doing my part, unless I were in the armed forces, and taking my share of the risks."

Ultimately, he was called and assigned to the development of the B-29's; he wrote me enthusiastically about them while they were still in the engineering stage, and when the time came to test them and train the crews, he was sent to Kansas and Oklahoma with them.

He has had his wish, and if he had known the end, I doubt whether it would have changed his mind. Some have to die in such a development as this. He was prepared to take his chances of being numbered with the lost.

He never talked of his own contributions to this development; that he made them is certain; that we shall ever know what they were is improbable. We have paid a heavy price, and glass technology is poorer, but our command of the skyways must thus be purchased.

If blood be the price of admiralty, Lord God, we ha' paid in full!

* * *

His broken bones and burnt body we have buried a few miles from here, at Mount Royal Cemetery, not far from the junction of Pine Creek and the Allegheny River, some fifty years too early. None of us now standing here will be here when the time comes that Meyer should have been gathered to his fathers, and few indeed of you younger men will remember, then, the loss of fifty years before. But the river will be there, and the creek. Fifty winters will see the stately procession of ice floes down the river, and fifty springs will hear the wild geese crying above the creek. For the wilderness is wiser than we, and longer of memory.

A nameless savage of the remotest part of Africa expresses it well in an Azande lament, brought back by Hayes Perkins from the upper Aruwimi:

When I shall have passed away,
Lay me not beside your dwelling:
You'll forget me, day by day.

Lay me by the flowing river
That the frogs and water-fowl
May bewail me there for ever.

And in this great city of steel, the words of Alfred Tennyson, in his own time of bereavement, naturally come back to us:

For life is not as idle ore
But iron dug from central gloom
And heated hot in burning fears
And dipped in baths of hissing tears
And battered with the shocks of doom
To shape, and use.

---

* Presented at the Autumn Meeting of the Glass Division, The American Ceramic Society, Inc., September 14, 1944, Pittsburgh, Pa. Received October 4, 1944.

See *Bull. Amer. Ceram. Soc.*, **23** [8] 263 (1944) for additional Meyer biographical data.

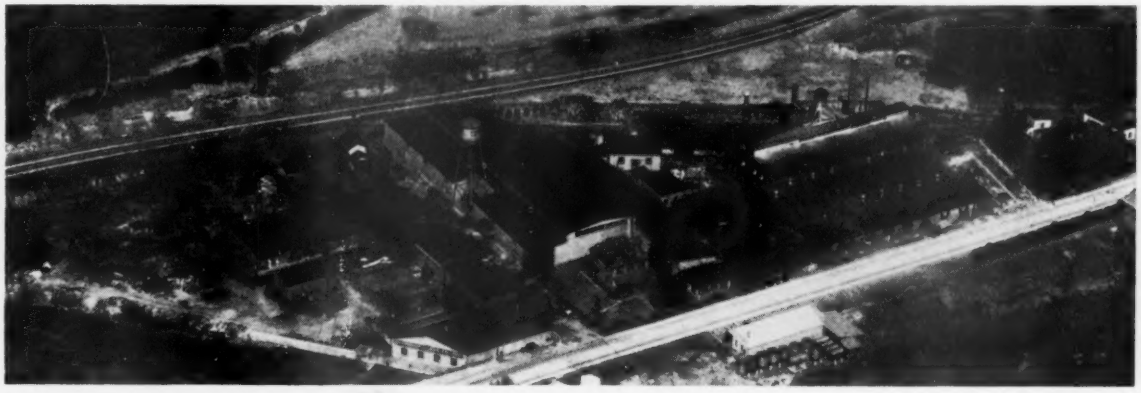

FIG. 2.—The Glenshaw Glass Company plant at Glenshaw, Pa., taken from the air in 1934 by F. W. Preston. The road is Pennsylvania Route 8, Pittsburgh to Butler and points north; the railroad is the B & O, formerly the B R & P. North is toward the left-hand corner.

FIG. 3.—Lawrence Thomas Sherwood (1886–1944).

(1944)

TOM SHERWOOD

The Laurels of Chestnut Ridge

The month that began so badly also finished badly.

We buried Tom Sherwood on July 29, on a hill near Scottdale, facing south toward his home in Connellsville and the scenes of his long struggles on behalf of adequate daylighting at Dunbar. His grave lies hard by the rough and twisting road from Dunbar to Butler, while to the east the mountains of Chestnut Ridge stand shoulder to shoulder, mile after mile.

He died too early, by human count, for he was not yet fifty-eight. It seemed likely that the next decade might have witnessed his most important contributions to his favorite technical problem—the proper use of daylight inside buildings; the curse of war, and of the great depression, had long held back their development, and now it will be for others to bring them to pass.

It was late in 1928 that I first made Sherwood's acquaintance. He had come to Butler, to see Walter Schweppe at the Standard Plate, on a technical problem. Mr. Schweppe referred him to me. I had left the Standard Plate a year before and was working, along with Jim Carrie, in a small room rented from the Standard Manufacturing Company (no connection with the Standard Plate) where the Kittanning Road crosses the Connoquenessing Creek. There was in those days no thought of the present Preston Laboratory, which was not established till about 1936 or 1937, but it seems to me fair to say that Sherwood's visit in 1928 was the factor that decided me to stay in America and to go into consulting work for the glass industry. In that sense Sherwood may be regarded as the founder of the Preston Laboratories, and Sherwood's company, the Pennsylvania Wire Glass Company, was its first client.

Lawrence Thomas Sherwood was born in Iowa late in 1886, of a Quaker family, and as Trader Horn used to say, "The Quakers are a people above par." He remained till his death a member of the Society of Friends, and his older son, Tom, Jr., now working at Northwestern on the chemistry of malaria, has followed in his steps.

Of his boyhood we know little; all his relatives of those days have long since passed away, but in his laboratory he kept a framed picture of a Morgan horse, apparently his

chief boyhood chum. In due course he went to Swarthmore, the Quaker college, near Philadelphia, and was graduated as a chemist. For some decades he was a member of the American Chemical Society.

Well over six feet tall, upright and well built, it is probable that he was something of an athlete, though he seemed unwilling to talk on the point. I suspect him of having a college record for the high jump, but I get the impression that he had no close college companions and did not go in for football or other riotous diversions. At no time does he seem to have been a "mixer," though he formed a modest number of staunch friendships, which nowhere failed before the death of one party or the other, after his college days.

He was for a time connected with the Du Pont Company, in the development of dyestuffs, and this gave a special turn to his interests in color. There is no question that his color vision was abnormally acute, and he ascribed this, in part at least, to his Du Pont training. Undoubtedly it influenced him in the development of the Pennsylvania Wire Glass Company's actinic glass. This glass is intended to cut off much of the infrared radiation of the sun, while passing a fairly high proportion of the visible. Other people, other technologists, had always approached this as a problem in physics—to get a sharp cutoff near the end of the visible spectrum. The result was usually a glass of a slightly bluish cast, very depressing, though some companies put a brave face upon it and described it as "restful" or "cooling." Sherwood approached the problem as one in psychology, and after consulting Dr. Luckiesh of General Electric (Nela Park) as to the color of light that produced the best seeing conditions and the greatest feeling of cheerfulness and well-being, deliberately made his glass an "unsaturated yellow." His competitors described it as "mud-colored," but it met with much approval from architects and continues to do so.

FIG. 4.—Walter Cox (1857–1929), formerly president, Pennsylvania Wire Glass Company.

Sherwood was singularly slow of speech, and it is rather remarkable to find him for a time a salesman for the Union Carbon & Carbide Company of Cleveland. He seems to have been comparatively successful, and in his later association with the Pennsylvania Wire Glass Company, he ascribed his ability to see what the customer, the glass user, really wanted, to his experience with Union Carbon & Carbide.

His connection with "PWG" is divided into two periods, and the man influencing his decision in both cases was its first president, Walter Cox (3). His first association was apparently from 1915 to 1917. The second was from 1925 till his death on July 26 of this year.

The history of the wire-glass industry in America is one of very bitter feeling from the very start, of severe competition and long periods of operating at a loss. Leadership in the industry seems never to have been very able or very forceful, and the most outstanding feature of some of the leaders was the picturesque language they used about each other. But even that was not characterized by great originality, and in the technological field, after the early inventions of the Shuman brothers, and the development of actinic by Sherwood, the level of invention has not been

FIG. 5.—Arno Shuman (1869–1939), formerly chief engineer, Pennsylvania Wire Glass Company. Inventor of corrugated wire glass.

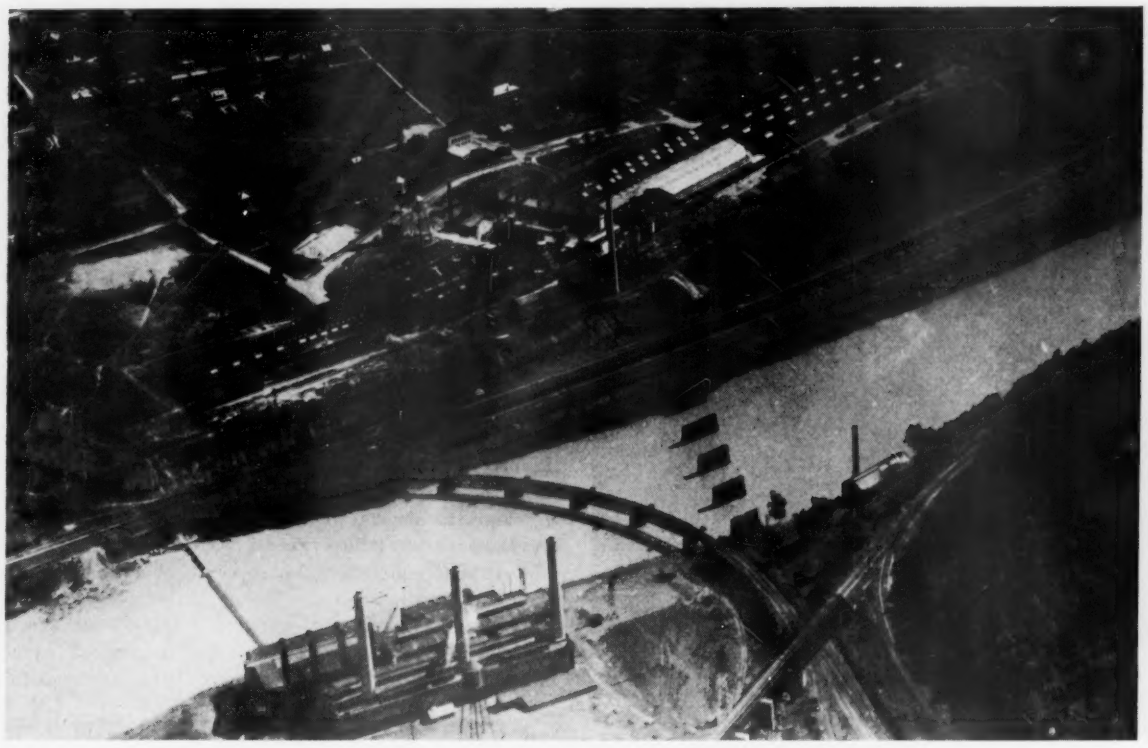

FIG. 6.—The Capstan plant of the Anchor Hocking Glass Corporation in Connellsville (in 1934). Here the "Yough," flowing from right to left, breaks through the lost pass of the mountains. The wooded area in the lower right is the spur of Chestnut Ridge separating the Yough from the Dunbar Creek. Tom Sherwood's home is just outside the picture to the upper left. (Photo by F. W. Preston.)

all that we might have hoped. Frank Shuman died many years ago, Arno Shuman relatively recently, and now Tom Sherwood has gone.

Sherwood attended the second Cove Point meeting of the Glass Division of The American Ceramic Society, and many of the other summer meetings subsequently. I think he rarely attended the spring meetings of the parent Society, and he rarely spoke from the floor. Endowed with a fine sense of humor, he was unable to make it effective, through sheer conscientiousness and studiousness. Only at one meeting, comparatively early in his career (not a ceramic meeting), he proved a brilliant and loquacious after-dinner speaker, in a completely extemporaneous address. The house applauded to the echo, and made him the honor speaker for next year. It did not work. He compiled his speech too thoroughly and studiously ahead of time, gave his audience the very best that was in him, and it fell flat. Only extemporaneously could he reach his best, and, not trusting himself for that, he rarely spoke in public afterwards. This is something of a pity, for his foresight extended far, his judgment was usually very sound, his unselfishness complete, his warnings wise and to the point; but that apparently lonely childhood and studious college career seem, after Walter Cox's death, to have developed an increasing reticence in public, and to have confined his opinions and views to his own company and a limited coterie of close friends.

He wrote innumerable memoranda, covering meticulously many phases of his business, indexed and cross-indexed, and could lay his finger on any of them, at a moment's notice, for twenty years back. There was material for many a scientific paper therein, but he seems to have dreaded the platform; or perhaps he was completely indifferent to it. He was tendered office in the Glass Division, but declined it, believing others with a readier tongue more profitable to The Society.

After Walter Cox's death, Sherwood took over his membership in the (British) Society of Glass Technology, and Professor Turner, I remember, visited him shortly afterwards at Dunbar. Turner is quite a mountaineer, in spite of his apparent frailty. I do not know whether they climbed Chestnut Ridge together, but I remember once climbing it with Sherwood and getting my foot caught in a cleft of the rocks and having to be extricated, after an interminable wait, by my companion. Sherwood knew all the mountain trails, and on some of them I used to ride horseback with him, and others we traveled on foot, among the rhododendron and the laurel. Sherwood was a powerful swimmer, and used to swim up and down the reservoirs of the Dunbar Creek, while I exhausted myself in short swims near one end of them. It looked to me as though he could swim all day if need be. Incidentally, all the wild rhododendron (*R. maximum*) and the laurel (*Kalmia latifolia*) on the Preston Laboratory grounds are a present from Sherwood and William Stevenson, plant manager of Pennsylvania Wire Glass, and come from Dunbar Creek.

Chestnut Ridge is the western wall of the Alleghenies. The Summit Hotel, above Uniontown, where the Glass

FIG. 7.—The mountain laurel (*Kalmia latifolia*). (Photo by O. E. Jennings.)

Division met in the fall of 1943, is on its crest. A few miles to the north, Dunbar Creek breaks out of the mountains, and just beyond, the Youghiogheny breaks completely through. The Pennsylvania Wire Glass Company's plant is in the first ravine; the Capstan plant of Anchor Hocking is at the mouth of the second, at the eastern end of Connellsville. Sherwood's little laboratory sits on the hillside above the creek; his home is across the mountain spur, above the river.

Of his two sons, the younger, John, left Carnegie Tech half way through his senior year to become a naval air cadet, and is now stationed in Illinois. The older boy, Tom, as mentioned before, a graduate of Swarthmore and Princeton, like a true Quaker, is trying to save life by working at Northwestern University in Evanston on the chemistry of malaria. Mrs. Sherwood is still at Connellsville.

In his own mind, Sherwood's life was not one of success, but rather one of perpetual failure and frustration. His program called for more technological talent than the industry could readily command, and more money than has been normally available. Time and again he found his ideas too far ahead of his friends', or found a promising development blocked for lack of funds. Proud and sensitive, he felt these failures keenly; but completely unselfish and without conceit, he fought with them till the end. Though very ill, he was at work the day before he died. Ever since an appendectomy some twenty years ago, he had felt his strength limited, and this internal inadequacy probably distressed him far more than any outward obstacle.

The palms of victory, in his own mind, were not his. Nor is it in our power to bestow upon him laurels as green and lasting as those he chose for himself. We leave him there by the mountains' edge with the laurels he loved the best, the Laurels of Chestnut Ridge.

UPSTATE NEW YORK SECTION

The third meeting of the Upstate New York Section of The American Ceramic Society was held October 27, 1944, at the Sherwood Hotel in Hornell, N. Y. The Section was favored with an attendance of 115 and the presence of numerous distinguished guests. S. F. Walton of the Exolon Company and W. J. Sutton of Alfred University spoke of plans for the New York State Ceramic Association meeting held at the New York State College of Ceramics the following day, October 28.

The Section was honored to have as its guest speaker H. L. Palmer of the General Electric Company who spoke on "Electronics Applied to Industry." Mr. Palmer discussed most thoroughly the present uses of electronic tubes in industry and pointed out how similar tubes might be used for controlling operations in the ceramic industry. He also showed slides to illustrate the construction, operation, and use of electronic tubes.

The next meetings of the Section will be held at Rochester, N. Y., December 8, 1944, and at Niagara Falls, N. Y., January 26, 1945. Anyone interested is invited to attend.

—M. H. BERNS, *Chairman*

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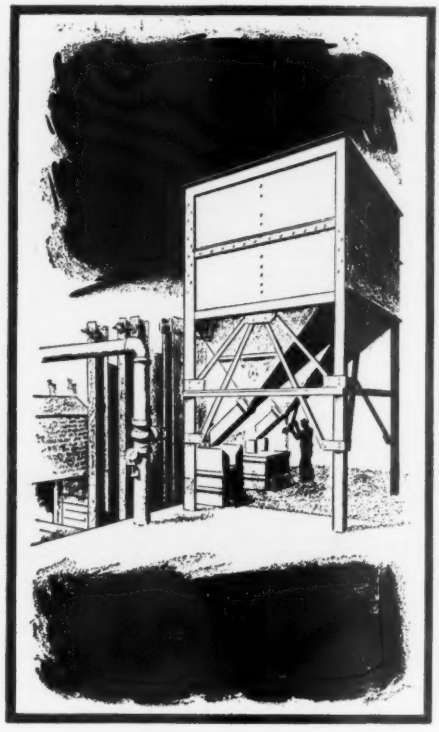

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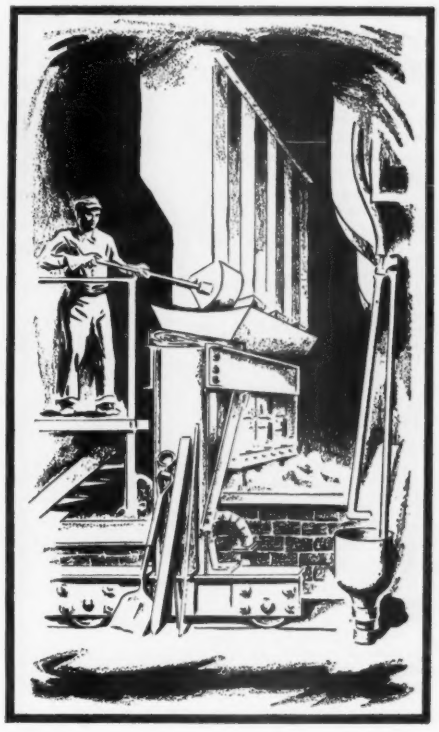

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Innis, Speiden & Co.
Vitro Mfg. Co.

Ammonium Carbonate
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Antimony Oxide
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Vitro Mfg. Co.

Antimony Sulphide
Foote Mineral Co.
Hommel, O., Co., Inc.

Arches (Interlocking, Suspending, and Circular)
Frazier-Simplex, Inc.

Arsenic
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Automatic Brick Car Loaders
Lancaster Iron Works, Inc.

Ball Mills
Hommel, O., Co., Inc.
McDanel Refractory Porcelain Co.
Vitro Mfg. Co.

Ball Mills (Laboratory Type)
Drakenfeld, B. F., & Co., Inc.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Barium Carbonate
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Barytes
Clinchfield Sand & Feldspar Corp.

Basic Oxides
Ferro Enamel Corp.
Hommel, O., Co., Inc.
Pemco Corp.

Batch Systems
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.

Batts
Carborundum Co. (*"Carbofrax Aloxite"*)
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)
Remmey, Richard C., Son Co.

Bentonite
Hammill & Gillespie, Inc.
Hommel, O., Co., Inc.

Beryl
Foote Mineral Co.

Bichromate of Soda
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Bitstone
Potters Supply Co.

Blocks (Refractory)
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Remmey, Richard C., Son Co.
Vitro Mfg. Co.

Body Stains
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Hommel, O., Co., Inc.

Bone Ash
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Borax
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Innis, Speiden & Co.
Pacific Coast Borax Co.
Stauffer Chemical Co.
Vitro Mfg. Co.

Borax Glass
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
Vitro Mfg. Co.

Boric Acid
Innis, Speiden & Co.

Boric Acid (Anhydrous)
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
Vitro Mfg. Co.

Boron Carbide
Norton Co.

Brick Machines (also Barrows, Molds)
Lancaster Iron Works, Inc.

Brick (Refractory)
Carborundum Co. (*"Carbofrax Aloxite"*)
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Remmey, Richard C., Son Co.
Vitro Mfg. Co.

Cadmium Sulphide
Drakenfeld, B. F., & Co., Inc.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Carbofrax (Refractory Products)
Carborundum Co.

Carbonates (Barium, Lead)
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Castings
Lancaster Iron Works, Inc.

Caustic Potash
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Solvay Sales Corp.

Caustic Soda
Du Pont de Nemours, E. I., & Co., Inc. Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Stauffer Chemical Co.
Vitro Mfg. Co.

Cements
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pennsylvania Salt Mfg. Co.
Remmey, Richard C., Son Co.

Ceramic Chemicals
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pemco Corp.
Pennsylvania Salt Mfg. Co.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Cerium Oxide
Drakenfeld, B. F., & Co., Inc.
Foote Mineral Co.
Hommel, O., Co., Inc.

Chromite (Natural Chromate of Iron)
Foote Mineral Co.
Hommel, O., Co., Inc.

Chromium Oxide
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.
Vitro Mfg. Co.

Clay (Ball)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Potters Supply Co.
Spinks, H. C., Clay Co.
Vitro Mfg. Co.

Clay (Bentonite)
Foote Mineral Co.
Great Lakes Foundry Sand Co.
Hommel, O., Co., Inc.

Clay (Block)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Clay (China)
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Vitro Mfg. Co.

Clay—Cleaners, Feeders
Lancaster Iron Works, Inc.

Clay (Electrical Porcelain)
Hammill & Gillespie, Inc.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Clay (Enamel)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Kentucky Clay Mining Corp.
Maxson, Elwyn L.
Metal & Thermit Corp.
Pemco Corp.
Spinks, H. C., Clay Co.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Clay (Fire)
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Potters Supply Co.

Clay (Micronized)
Pemco Corp.

Clay Miners
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Clay (Potters)
Hammill & Gillespie, Inc.
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Clay (Sagger)
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Hommel, O., Co., Inc.
Maxson, Elwyn L.
Potters Supply Co.
Spinks, H. C., Clay Co.

Clay-Slip (Albany)
Hammill & Gillespie, Inc.
Hommel, O., Co., Inc.

Clay (Wad)
Kentucky Clay Mining Co.
Potters Supply Co.
Spinks, H. C., Clay Co.

Clay (Wall Tile)
Hammill & Gillespie, Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Cleaners
Pemco Corp.
Pennsylvania Salt Mfg. Co.

Cleaners, Chemical
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.

Clocks (Gauge Board)
Hommel, O., Co., Inc.

CO_2 Recorders
Leeds & Northrup Co.

Cobalt, Oxide
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.
Vitro Mfg. Co.

Cobalt Sulphate
Drakenfeld, B. F., & Co., Inc.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Colors
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Combustion Control
Leeds & Northrup Co.

Combustion Meters (CO_2 Recorders)
Leeds & Northrup Co.

Cone Plaques
Industrial Ceramic Products, Inc.

Cones
Edward Orton, Jr., Ceramic Foundation

Controllers—Automatic Tank Pressure
Leeds & Northrup Co.

Conveying Equipment
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Lancaster Iron Works, Inc.

Copper Oxide
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.

Crucibles (Filter, Melting, Ignition)
Carborundum Co.
Norton Co.
Potters Supply Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.
Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Industrial Ceramic Products, Inc.

Decorating Supplies
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

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Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Dryers (Waste Heat, Continuous and Batch Type)
Harrop Ceramic Service Co.

Drying Machinery
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Lancaster Iron Works, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enamelers' Borax
Hommel, O., Co., Inc.
Pemco Corp.

Enameling Equipment (Complete)
Ferro Enamel Corp.
Frazier-Simplex, Inc.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
Ferro Enamel Corp.
Hommel, O., Co., Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.

Enameling Muffles
Carborundum Co. (*Carbofrax*)
Frazier-Simplex, Inc.
Norton Co. (*Alundum*)

Enameling (Practical Service)
Ferro Enamel Corp.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Enamels
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.
Vitro Mfg. Co.

Enamel Oxide
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Hommel, O., Co., Inc.

Enamels (Porcelain)
Ferro Enamel Corp.
Hommel, O., Co., Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Engineering Service
Ferro Enamel Corp.
Harrop Ceramic Service Co.

Epsom Salts
Innis, Speiden & Co.

Equipment (Porcelain Enameling)
Ferro Enamel Corp.
Hommel, O., Co., Inc.

Feldspar
Clinchfield Sand & Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
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Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Remmey, Richard C., Son Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Great Lakes Foundry Sand Co.
Spinks, H. C., Clay Co.

Flint
Clinchfield Sand & Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Great Lakes Foundry Sand Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.

Flint Pebbles
Clinchfield Sand & Feldspar Corp.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Flint (Soft decomposed Cararra)
Innis, Speiden & Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.
Hommel, O., Co., Inc.

French Flint
Maxson, Elwyn L.

Frit
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
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Ferro Enamel Corp.
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.
Hommel, O., Co., Inc.
Swindell-Dressler Corp.

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Furnaces, Enameling
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Swindell-Dressler Corp.

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Leeds & Northrup Co.

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Hays Corp.

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Frazier-Simplex, Inc.

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Great Lakes Foundry Sand Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

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Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Vitro Mfg. Co.

Glazes and Enamels
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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Glaze Spar
Clinchfield Sand & Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
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Hommel, O., Co., Inc.
Maxson, Elwyn L.

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Harshaw Chemical Co.
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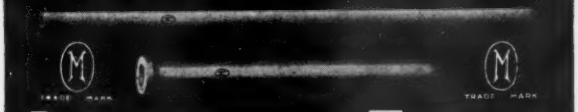

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Hommel, O., Co., Inc.
Pemco Corp.
Vitro Mfg. Co.

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Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Vitro Mfg. Co.

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Electro Refractories & Alloys Corp.
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Ferro Enamel Corp.—Allied Engineering Div.
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Remmey, Richard C., Son Co.

Kryolith (see Cryolite)
Pennsylvania Salt Mfg. Co.

Laboratory Ware
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Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Remmey, Richard C., Son Co.
Vitro Mfg. Co.

Lithium Carbonate
Drakenfeld, B. F., & Co., Inc.
Foote Mineral Co.
Hommel, O., Co., Inc.

Lithium Minerals
Foote Mineral Co.

Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.

Magnesia (Sintered,Calcined)
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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.

Magnesite
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Magnesite Calcined
Foote Mineral Co.
Hommel, O., Co., Inc.

Magnesium Carbonate
Drakenfeld, B. F., & Co., Inc.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Manganese
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Manganese Dioxide
Drakenfeld, B. F., & Co.
Ferro Enamel Corp.
Foote Mineral Co.
Hommel, O., Co., Inc.

Manganese (Oxide)
Corhart Refractories Co.
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Masks (Breathing)
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Hommel, O., Co., Inc.

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Spencer Lens Co.

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Spencer Lens Co.

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Norton Co.

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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

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Overglaze Colors
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Ferro Enamel Corp.
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Oxides
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Ferro Enamel Corp.
Harshaw Chemical Co.
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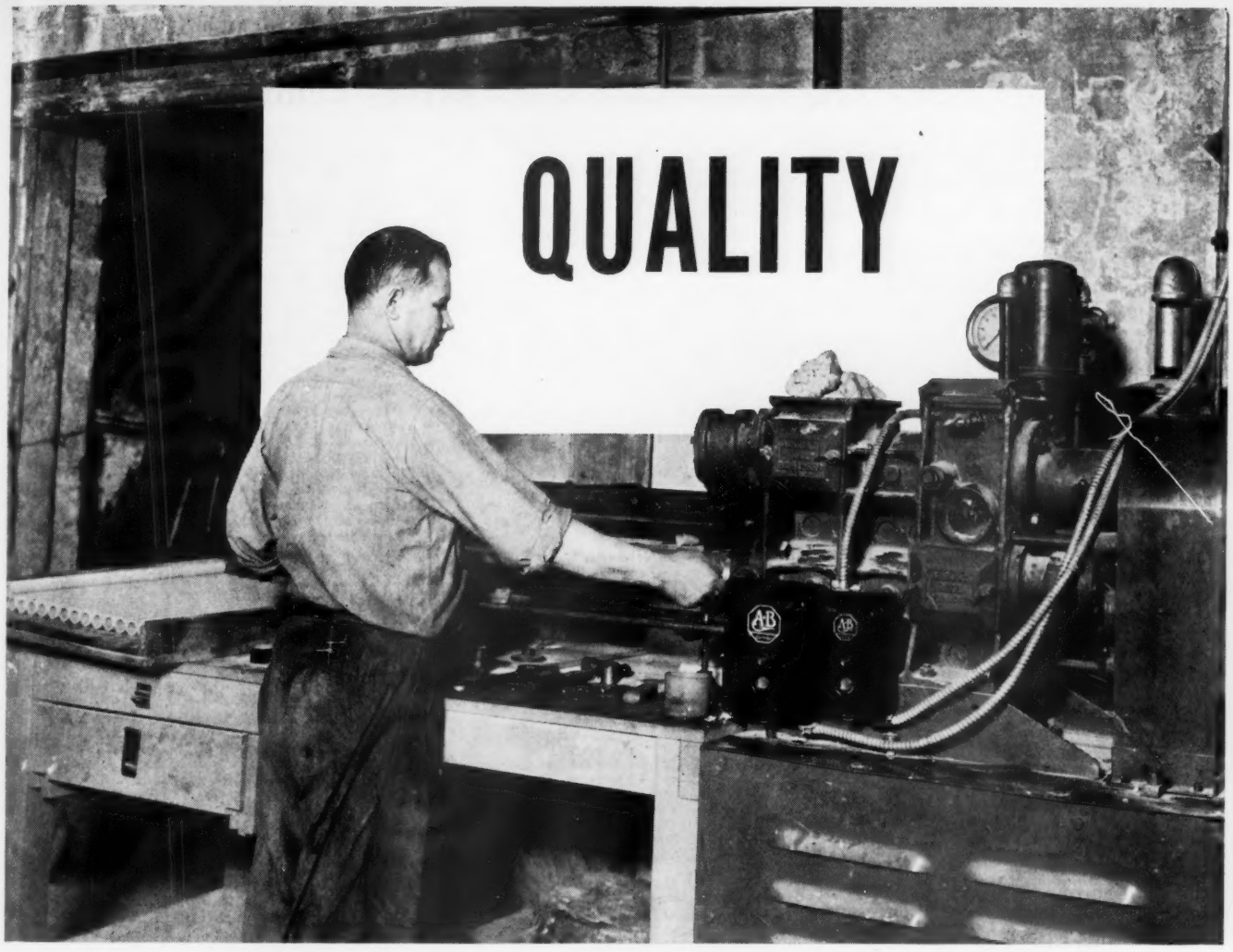

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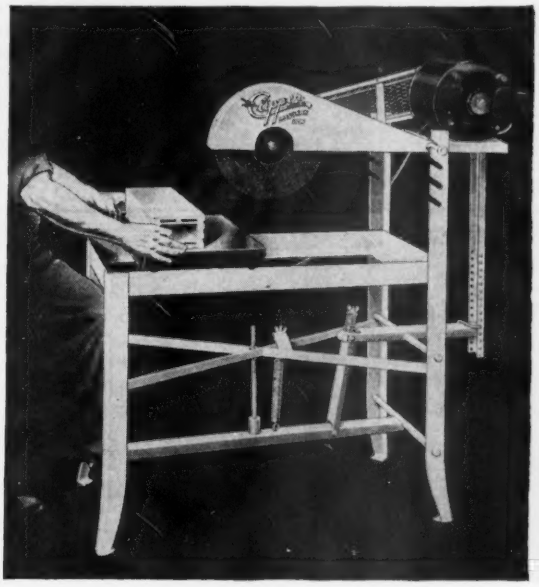

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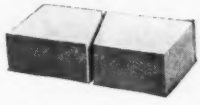

This acid brick intended for a chemical plant acid chamber was cut completely in two, in just 37 seconds.

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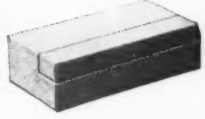

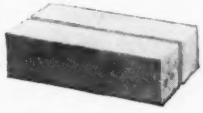

Silica brick cut lengthwise for open hearth furnace work, only 9 seconds were required to complete this cut!

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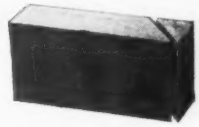

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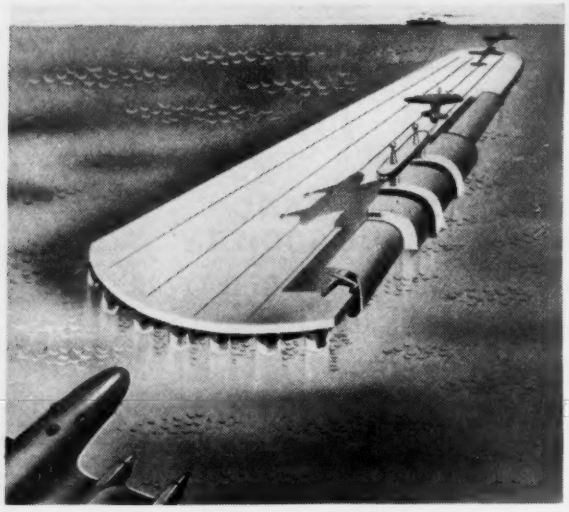

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1 **BOND COMMITTEE**—Appoint a 6th War Loan Bond Committee from labor, management and each representative group of the firm.

2 **TEAM CAPTAINS**—Select a team captain, for each 10 workers, from men and women on the payroll—but not in a supervisory capacity. Returned veterans make most effective captains.

3 **QUOTA**—Set a quota for each department and each employee.

4 **MEETING OF CAPTAINS**—Give a powerful presentation of the importance of the work assigned to them. Instruct them in sales procedure. Have them carefully study the Treasury Booklet, *Getting the Order.*

5 **ASSIGNMENTS**—Assign responsibilities for:

(a) *Music, speeches and announcements of the opening rally.*
(b) *Pre-drive letter to employees from management and labor.*
(c) *Competitive progress boards.*
(d) *Meeting schedules, etc.*

6 **CARD FOR EACH WORKER**—Dignify each personal approach with a pledge, order, or authorization card made out in the name of each worker. Provide for a cash purchase or installment pledge. Instruct each captain to put a pencil notation on the card to indicate the subscription he expects to solicit from each worker.

7 **RESOLICITATION**—People don't mind being asked to buy more than once. Resolicit each employee toward the end of the drive in a fast mop-up campaign. Call upon your State Payroll Chairman; he's ready with a fully detailed plan—NOW!

8 **ADVERTISE THE DRIVE**—Use all possible space in the regular media you employ to tell the War Bond story.

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If You're Waiting for a Home Telephone

IF YOU are waiting for a home telephone, we think we know how you feel.

You'd like a telephone now—not weeks or months from now. And we'd like to install it for you now.

But due to the war we are short of switchboards and telephones, so there will be unavoidable delays in filling orders for home telephones.

The delay will be as short as we can make it. Meantime, we are genuinely grateful for your patience and co-operation.

BELL TELEPHONE SYSTEM

SPINKS

High Grade—Uniform Quality Clays

Types to Suit Your Individual Needs

Ball

Sagger

Wad

CLAYS

The Spinks organization offers you the highest grade clays—all mined and stored under the strictest supervision and with the most modern equipment. Ample storage facilities assure you prompt shipment and low moisture content.

Write Us for Samples

H. C. SPINKS CLAY CO.

P. O. BOX 256 - - NEWPORT, KY.

INCREASE SALEABILITY WITH ULTROX

M & T's new, super-refined zirconium opacifer—ULTROX—produces whiter glazes with smoother surface texture that mean an increase in your product's saleability.

Follow the footsteps of many other leading manufacturers to M & T's Ceramic Laboratory, where you'll find the answers to your glaze or enamel problems—production hints that will pave the way for product improvement and lower costs.

PROMPT DELIVERY?
YES!
ULTROX
Sodium Antimonate
Antimony Oxide
Zircon
We ship from stock for immediate delivery.

METAL & THERMIT CORPORATION
120 Broadway, New York 5, N. Y.

CERAMIC DIVISION